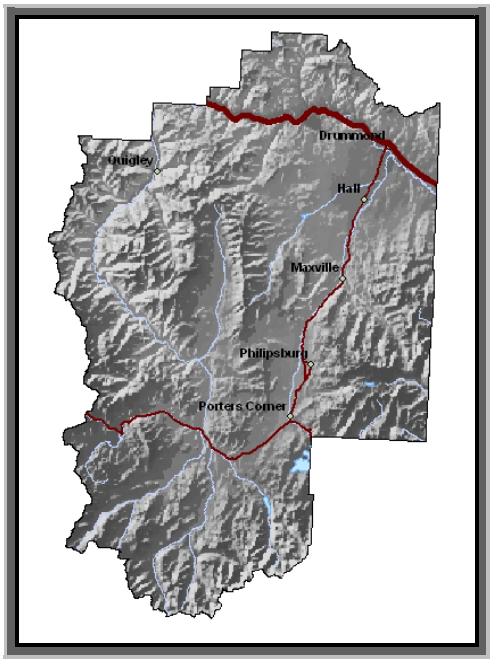
GRANITE COUNTY, MONTANA
TOWN OF DRUMMOND, MONTANA
TOWN OF PHILIPSBURG, MONTANA

HAZARD MITIGATION PLAN

November 2005



Prepared by:

BIG SKY HAZARD MANAGEMENT LLC

4855 South Third Avenue ▪ Bozeman, MT 59715
406-581-4512 ▪ www.bigskyhazards.com

Granite County Hazard Mitigation Plan
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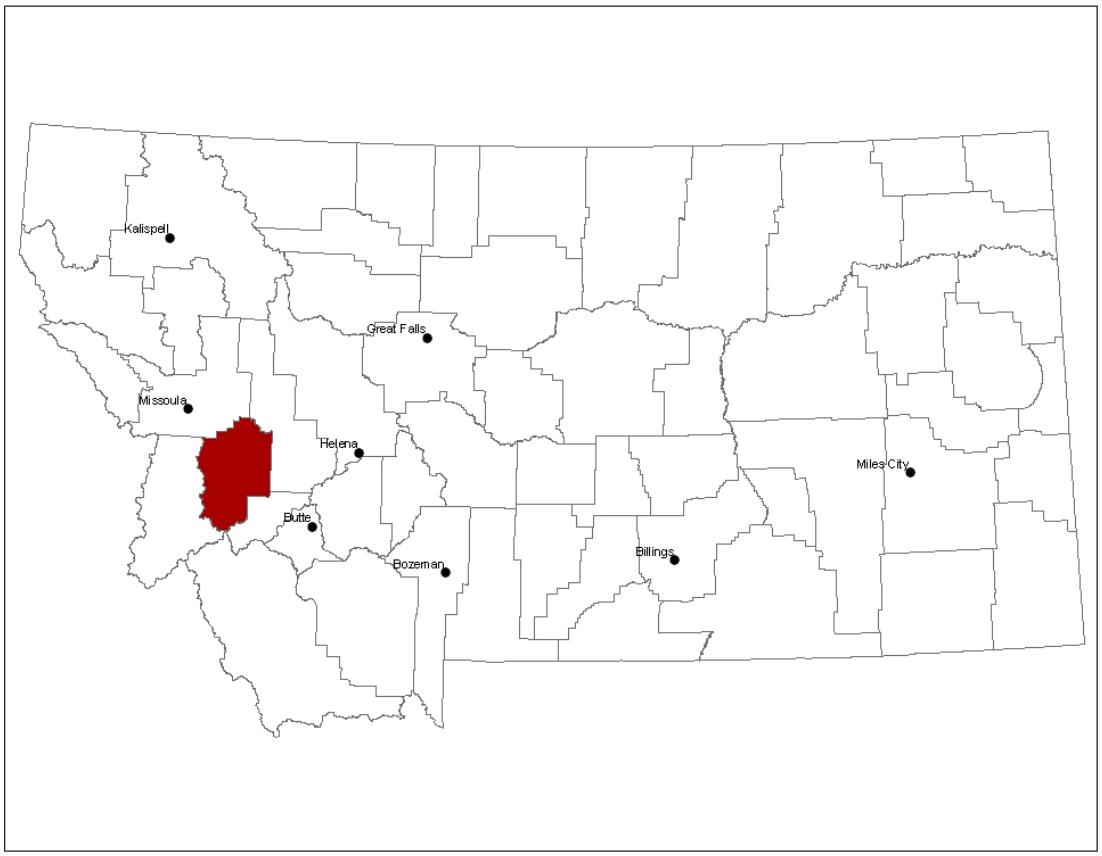
1. Adoption Documentation

2. Introduction

Granite County, Philipsburg, and Drummond, Montana are taking the steps necessary to become disaster resistant communities, and through their initiative, are writing a plan to meet the requirements of the Interim Final Rule published in the Federal Register on February 26, 2002 at 44 CFR Part 201 as part of the Disaster Mitigation Act of 2000. The initial planning document was funded by Montana Disaster and Emergency Services. The plan's intent is to assist the communities in making financial decisions for mitigation projects and clarify actions that could be taken through additional funding. Hopefully through the planning process, the communities have become more aware of their hazards and will continue to take proactive approaches to disaster prevention.

Granite County is located in Western Montana as shown in Map 2.1. According to the 2000 US Census data, Granite County has a population of 2,830 and an area of 1,727 square miles. Two incorporated towns, Philipsburg and Drummond, are within the county. Philipsburg, the county seat, has a population of 914. Drummond, located near Interstate 90, has a population of 318. The county is bordered on the northwest by Missoula County, the northeast by Powell County, the southeast by Deer Lodge County, and the west by Ravalli County.

Map 2.1 Granite County's Location within Montana



The Pintler Scenic Route, a popular scenic bypass of Interstate 90 passes through much of Granite County. Residents enjoy the convenience of traveling to Missoula or Butte, both about an hour away from Philipsburg, while remaining within close proximity to beautiful mountains in the rural area. The

area is known for its year-round recreation activities, historic mines, and ghost towns. Several mountain ranges surround the communities of Granite County: the Sapphire Mountains to the west, the Flint Creek Range to the east, and the Anaconda Range to the south. Federal lands account for approximately 64 percent of the total land area of the county. Federal land holdings include portions of the Lolo National Forest - Missoula District and the Beaverhead-Deerlodge National Forest - Philipsburg District, both managed by the US Forest Service. The Continental Divide traverses the southeastern border and elevations range from 3,950' to 8,450' across the county.

Philipsburg started as a mining town during the gold rush of the 1860's and was designated a town in 1867 and the county seat of the newly formed Granite County in 1893. Populations have fluctuated from 36 to 3,000 depending on the successes of the mining industry. During the mining "bust" years, the economy relied on exporting ranching and logging goods. Drummond was named in 1884, and since the completion of the railroad in 1883, has been a center for shipping goods, mine ores, and cattle from Granite County. Georgetown Lake, at the southern end of Highway 1 in Granite County, was formed by a dam put in place in 1885 to support the mining industry and now serves as a popular recreation area year-round.[1] Granite County has had a fairly stable population of about 2,800 since 1970. The county is now experiencing subdivision growth with the mining and timber industries continuing to decline.

The climate of Granite County is typical of most Montana areas with warm, dry summers and cold, snowy winters. Table 2.2 shows data from two stations in Granite County – Drummond with data recorded since November 1, 1928 and Philipsburg recording from September 16, 1903. The locations of these stations have varied over the years but have stayed in the same general vicinity.

Table 2.2 Granite County Weather Statistics[2]

	Drummond 1928-2004	**Philipsburg 1903-2004**
Minimum Temperature	-48°F	-40°F
Maximum Temperature	104°F	98°F
Average # of Days Dropping Below Freezing	216 days	217 days
Average # of Days Staying Below Freezing	46 days	44 days
Average Precipitation (liquid equivalent)	11.9 inches	14.8 inches
Lowest Annual Precipitation	6.45 inches	7.28 inches
Highest Annual Precipitation	22.22 inches	24.80 inches
Average Snowfall	38.8 inches	55.5 inches
Highest Annual Snowfall	101.3 inches	140 inches
Highest Daily Snowfall	16.5 inches	32 inches

Granite County is prone to many types of weather related hazards including winter storms, extended cold, wind, severe thunderstorms, tornadoes, drought, and flooding. The geology of Granite County also puts the area at risk for geological hazards. Earthquakes have been known to shake the region periodically and the mountainous slopes throughout the county present avalanche and landslide

[1] Philipsburg Territory. Vol. VI, No. 2. 2004.
[2] Western Regional Climate Center, October 2004. http://www.wrcc.dri.edu/.

hazards. With much of the County covered by mountainous forests and grassy valleys, wildfires are also a frequent problem during dry summers. The volcanic areas of the Cascade Range to the west and the Yellowstone Caldera to the southeast pose the ever present possibility of volcanic ashfall on Granite County.

Despite the small town, rural feel of Philipsburg, Drummond, and the other communities in the county, manmade hazards also exist. US Interstate 90, railroads, airports, and fixed facilities put the county at risk for hazardous material releases and transportation incidents. Communicable disease, dam failure, terrorism, utility and communications failure, and water supply and watershed contamination all have the potential to affect the communities.

Despite these hazards, Granite County, the Town of Philipsburg, and the Town of Drummond hope this plan identifies those hazards that greatest threaten the communities and outlines solutions to mitigate future damages. Additional hazards may exist that are not apparent to the local government or residents, and certainly hazards can occur in unexpected ways. Although any and all hazards cannot be fully mitigated, hopefully, this plan will help the communities understand the hazards and become more disaster resistant.

3. Planning Process

The planning process used in developing this Hazard Mitigation Plan attempted to maximize community input and utilize a wide variety of informational resources. Appendix A contains the public meeting notices and Appendix B provides the meeting sign-in sheets. Given the small number of resources available to write the plan, a consulting firm, Big Sky Hazard Management LLC, was hired to coordinate and facilitate the plan writing process.

The planning process began in October 2004 with an advertised public meeting. This meeting generated very little public interest and served as an orientation to the Pre-Disaster Mitigation Plan process for the Disaster and Emergency Services Coordinator. A list of important public officials that should be part of the planning process was generated. This group consisted of representatives from emergency management, fire services, medical and health services, public works, State and Federal government, law enforcement, chief elected officials, administrative officials, news media, and the public. All jurisdictions, Granite County, Philipsburg, and Drummond, were included in this list of stakeholders. A preliminary list of critical facilities and vulnerable populations was also created.

The second public meeting in April 2005 was advertised through an article and a letter to the editor from the Disaster and Emergency Services Coordinator in the Philipsburg Mail newspaper. Personal invitations were extended to the important officials identified at the first public meeting. Attendees of this meeting were introduced to the reasons for mitigation planning and the Pre-Disaster Mitigation planning process. Hazards were then identified and participants were surveyed on their primary hazard concerns. Critical facilities and vulnerable populations were also reviewed and additionally identified in this workshop. All jurisdictions were represented at this meeting.

The third public meeting was held in May 2005. This meeting focused on reviewing historical hazard information and hazard mapping. An extensive discussion of each hazard's history was conducted with the knowledgeable attendees, including several long-time residents. After the hazards and mapping were reviewed, attendees brainstormed several potential mitigation goals, objectives, and projects.

Final public comments on the full draft plan were solicited from December 30, 2005 – January 20, 2006. Future updates of this plan will continue to encourage public input as described in the *Plan Maintenance Procedures* section.

4. Risk Assessment

This all-hazard risk assessment serves as a single, consolidated source of hazard information for Granite County. Other plans may be referenced and remain vital hazard documents, but each hazard has its own profile in this plan. As more data becomes available and disasters occur, the individual hazard profiles can be expanded or new hazards added. This summary of hazards identifies and describes the hazards that threaten Granite County and determines the values at risk from those hazards. The risk assessment is the cornerstone of the mitigation strategy and provides the basis for many of the proposed actions.

Hazard Identification

Granite County is exposed to many hazards. The hazards were identified and profiled through several different means. Hazards were initially identified by the Disaster and Emergency Service Coordinator and participants at the second public meeting. Participants from each of the jurisdictions were present. Then, a history of past events was gathered and possible future events were recognized through internet research, available GIS data, additional public meetings, subject matter experts, and an examination of existing plans.

The hazards (in alphabetical order) have been identified as follows in Table 4.1. The level of detail for each hazard is based on the relative risk of each hazard to the community and is limited by the amount of data available.

Table 4.1 Hazards Identified in Granite County, Montana

Hazard	Jurisdiction	How Identified	Why Identified
Avalanche and Landslide	• Granite County	• State DES Website • Historical records from the Avalanche.org database • Colorado Avalanche Information Center • Montana Hazard/Vulnerability Analysis, 1989 • USGS National Landslide Study • Montana Department of Transportation District 2 Priorities	• Mountainous terrain exists that may be prone to avalanches • Avalanches and landslides have occurred in Granite County • Priority landslide areas exist along roadways in the county
Communicable Disease	• Granite County • Philipsburg • Drummond	• Centers for Disease Control and Prevention website • Public meeting input	• Potential disease spread from rapid worldwide travel
Dam Failure	• Granite County • Drummond	• National Inventory of Dams website • Dam Emergency Action Plans	• Four high hazard dams exist in the county • History of a near-failure of a high hazard dam
Drought	• Granite County • Philipsburg • Drummond	• Montana Drought Advisory Committee website • National Drought Mitigation Center website • Data from the Western Regional Climate Center • State DES website • NOAA Paleoclimatology Program website	• Frequent historical drought events • USDA Disaster Declarations • Relationship to wildfire danger • Impact to agricultural community • Impact on natural resources and tourism

Table 4.1 Hazards Identified in Granite County, Montana (continued)

Hazard	Jurisdiction	How Identified	Why Identified
Earthquake	• Granite County • Philipsburg • Drummond	• Montana Bureau of Mines and Geology publication and website • USGS National Seismic Hazard Mapping Project website • University of Utah Seismograph Stations website • USGS National Earthquake Information Center website	• History of nearby earthquakes greater than 6.0 magnitude • Proximity to the Intermountain Seismic Belt and Centennial Tectonic Belt
Flooding	• Granite County • Philipsburg • Drummond	• FEMA Flood Insurance Study and Rate Maps	• Extensive history of riverine and stream flooding
Hazardous Materials Release	• Granite County • Philipsburg • Drummond	• National Response Center database • Public meeting input	• Regular interstate and railroad traffic transport hazardous materials through the county
Terrorism	• Granite County • Philipsburg • Drummond	• Centers for Disease Control website • Southern Poverty Law Center website • Anti-Defamation League website	• Heightened alert since September 11, 2001
Transportation Accident	• Granite County • Philipsburg • Drummond	• Research of NTSB database • Federal Railroad Administration database • Public meeting input	• The county has two airports, an interstate, and an active railroad • History of incidents, particularly near Drummond
Utility and Communications Outage	• Granite County • Philipsburg • Drummond	• Public meeting input	• Dependence of population on utility services • Dependence of emergency services on communications
Volcanic Ash	• Granite County • Philipsburg • Drummond	• Montana Hazard/Vulnerability Analysis • Public meeting input	• History of ashfall over the county
Water Supply and Watershed Contamination	• Philipsburg	• Public meeting input	• High vulnerability of water supply
Wildfire	• Granite County	• USFS Records • Public meeting input • Community Wildfire Protection Plan	• Mountainous, forested, and flammable terrain exists throughout the county • History of significant wildfires • Growth in the wildland/urban interface
Wind, Tornadoes, and Severe Thunderstorms	• Granite County • Philipsburg • Drummond	• National Climatic Data Center database • National Weather Service website	• High winds and severe thunderstorms, some causing damage, have occurred in recent history
Winter Storms and Extended Cold	• Granite County • Philipsburg • Drummond	• Western Regional Climate Center database • Public meeting input	• History of extreme cold and heavy snow events • Potential for power outages during a cold spell

Assets and Community Inventory

An important piece of assessing the communities' risks to the studied hazards is recognizing what assets are more vulnerable to those hazards than others. Identifying the assets in the communities is the first step in assessing the vulnerabilities. In many cases, once important facilities are identified, they can then be prioritized for mitigation. Examples of community assets include the population, critical facilities, government (publicly owned) facilities, businesses, residences, structures housing vulnerable populations, road and utility infrastructure, natural resources, and the economy. The most important facilities typically protect the continuity of government, the safety of the population, or the economy.

Critical Facilities

Two different types of critical facilities exist, those that are necessary to maintain essential community services, and those that house vulnerable populations. Those facilities that are considered vital to public safety such as law enforcement, fire services, health services, communications, hazardous materials storage, and other government services have been identified as **critical facilities**. Examples of facilities housing particularly vulnerable populations include elderly housing and schools. These facilities were identified by local officials and through additional research. The tables and maps that follow specify the critical facilities and locations of vulnerable populations.

Table 4.2 Critical Facilities – Local Government Facilities

Name	Address
Granite County Courthouse	220 North Sansome Street, Philipsburg
Philipsburg Town Hall and Library	104 South Sansome Street, Philipsburg
Drummond Town Hall and Library	114 A Street, Drummond
Granite County Sheriff's Office/911/EOC/Jail	115 East Kearney Street, Philipsburg

Table 4.3 Critical Facilities – Fire Stations and Emergency Medical Services

Name	Address
Philipsburg Volunteer Fire Department and Ambulance	West Broadway Street, Philipsburg
Philipsburg Ambulance	West Kearney Street, Philipsburg
Valley Rural Fire District/Drummond Fire	434 East Front Street, Drummond
Drummond Ambulance	204 East Front Street, Drummond
Georgetown Lake Fire Service Area	306 Lake Shore Drive, Anaconda
Georgetown Lake QRU	
Rock Creek QRU	
Granite County Medical Center/Nursing Home	310 South Sansome Street, Philipsburg

Table 4.4 Critical Facilities – Utility and Communication Facilities

Name	Address
Philipsburg/Granite County Landfill	70 Haul Road, Philipsburg
Philipsburg Water Tanks	31 Stewart Lake Road, Philipsburg
Philipsburg Water Facility	North Granite Road, Philipsburg
Philipsburg Power Facility	Power Plant Road, Philipsburg
Philipsburg Power Facility	Gonq Road, Philipsburg
Flint Creek Hydroelectric Plant	111 Power House Road, Philipsburg
Drummond Refuse Site	20 Sorenson Lane, Drummond
Drummond Water Tower/Well House	80 South Main Street, Drummond
Drummond Sewage Lift Station	6381 MT Highway 1, Drummond
Bonneville Power Substation	Stage Coach Road, Drummond

Table 4.4 Critical Facilities – Utility and Communication Facilities (continued)

Name	Address
Northwestern Energy Substation	South Montgomery Street, Philipsburg
Northwestern Energy Substations	South Main Street, Drummond
Yellowstone Pipeline Substation	214 East Mullan Trail, Drummond
Blackfoot Telephone Interchange	205 East Broadway, Philipsburg
Blackfoot Telephone Substation	129 ½ East Broad Street, Drummond
Qwest Telephone Substation	1442 West Mullan Trail, Clinton
Northwestern Energy Natural Gas Substation	92 West Mullan Trail, Drummond
Northwestern Energy Natural Gas Substation	South Main Street, Drummond
Northwestern Energy Natural Gas Substation	Pearl Street, Philipsburg
Cenex Bulk Plant (80K gallons of propane)	Philipsburg
Cenex Bulk Plant (propane)	229 East Front Street, Drummond
Rumsey Mountain Repeater Site	46-15-45 Latitude, 113-14-47 Longitude, 2,494 Meters Elevation
Slide Rock Repeater Site	46-35-21 Latitude, 113-33-17 Longitude, 2,344 Meters Elevation
Granite County Sheriff's Office/911 Repeater Site	46-20-00 Latitude, 113-47-47 Longitude, 1,599 Meters Elevation
Ravena Repeater Site (Future Site)	46-42-15 Latitude, 113-17-33 Longitude, 1,758 Meters Elevation
Beacon 42 Repeater Site (Future Site)	46-44-48 Latitude, 113-37-20 Longitude, 1,783 Meters Elevation

Table 4.5 Critical Facilities – Transportation Facilities

Name	Address
Philipsburg Town Shop	Brown Street, Philipsburg
County Maintenance Shop – Hall	104 South Broadway Avenue, Hall
County Maintenance Shop – Philipsburg	439 School Hill Road, Philipsburg
Montana Department of Transportation	3798 US Highway 1, Philipsburg
Montana Department of Transportation	6283 MT Highway 1, Drummond
Montana Department of Transportation	1687 Drummond Frontage Road, Clinton
Montana Department of Transportation Weigh Station	Interstate 90, Drummond
Riddick Field Airport	1 mile Southeast of Philipsburg
Drummond Airport	3 miles Southwest of Drummond
Granite County Memorial Hospital Heliport	310 South Sansome Street, Philipsburg

Table 4.6 Critical Facilities – State and Federal Facilities

Name	Address
US Post Office	234 East Broadway Street, Philipsburg
US Post Office	101 East Main Street, Hall
US Post Office	60 East Broad Street, Drummond
Beaverhead/Deerlodge NF, Pintler Ranger District	88 10-A Business Loop, Philipsburg
Lolo NF, Rock Creek Ranger Station	2819 Rock Creek Road, Clinton
USDA Service Center and DNRC Offices	105 South Holland, Philipsburg

Table 4.7 Vulnerable Populations

Name	Address	Population
Granite County Medical Center/Nursing Home	310 South Sansome Street, Philipsburg	5 hospital beds, 28 nursing home beds
Philipsburg Multi-Purpose Center/Senior Center	103 East Broadway, Philipsburg	
Drummond Multi-Purpose Center/American Legion	112 A Street, Drummond	
Philipsburg Elementary School	407 Schnepel Street, Philipsburg	135 students

Table 4.7 Vulnerable Populations (continued)

Name	Address	Population
Granite High School	507 Schnepel Street, Philipsburg	75 students
Drummond Elementary School	30 West Edwards, Drummond	140 students
Drummond High School	108 West Edwards, Drummond	85 students
Hall Elementary School	109 West Main Street, Hall	25 students

Buildings

In addition to the critical facilities, other structures such as residences and businesses are also vulnerable to hazards. Based on 2000 US Census Data, the population of Granite County is 2,830 with 2,074 housing units, 1,200 of which are occupied and 682 are seasonal. Of the housing units, 506 are in Philipsburg and 172 are in Drummond. The median value of those owner-occupied housing units is $78,300. Also, 87 private, non-farm establishments with employees and 432 non-employer establishments exist. A further breakdown of the housing units can be found in Table 4.8.

Table 4.8 2000 US Census Housing Data for Granite County[3]

Units in Structure	Granite County TOTAL	Philipsburg	Drummond	Unincorporated Areas of Granite County
1-unit, detached	1,552	346	104	1,102
1-unit, attached	10	4	4	2
2 units	18	13	5	0
3 or 4 units	40	28	12	0
5 to 9 units	8	2	6	0
10 to 19 units	5	3	2	0
20 or more units	0	0	0	0
Mobile home	437	110	39	288
Boat, RV, van, etc.	4	0	0	4
Year Structure Built	**Granite County TOTAL**	**Philipsburg**	**Drummond**	**Unincorporated Areas of Granite County**
1999 to March 2000	43	10	0	33
1995 to 1998	141	24	0	117
1990 to 1994	144	16	6	122
1980 to 1989	246	50	7	189
1970 to 1979	408	71	34	303
1960 to 1969	212	37	15	160
1940 to 1959	385	71	55	259
1939 or earlier	495	227	55	213

[3] Montana Department of Commerce, Census and Economic Information Center. July 2005. http://ceic.commerce.state.mt.us/demogProPlace.htm.

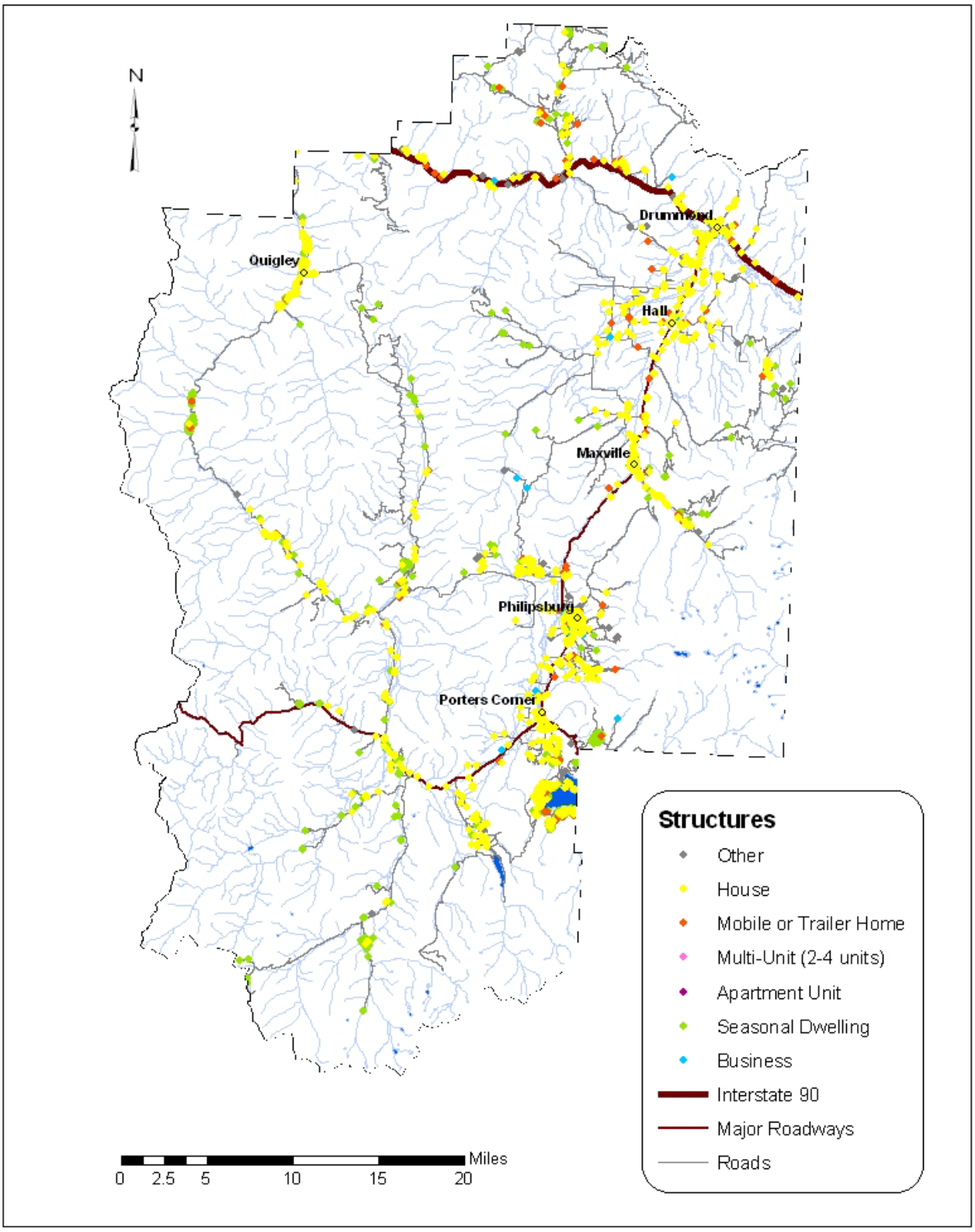
Table 4.8 2000 US Census Housing Data for Granite County[3] (continued)

Value of Owner-Occupied Units	Granite County TOTAL	Philipsburg	Drummond	Unincorporated Areas of Granite County
Less than $50,000	120	71	23	26
$50,000 to $99,999	223	104	31	88
$100,000 to $149,999	83	14	9	60
$150,000 to $199,999	56	8	0	48
$200,000 to $299,999	17	0	0	17
$300,000 to $499,999	12	4	0	8
$500,000 to $999,999	4	0	0	4
MEDIAN	$78,300	$71,300	$57,100	$83,449

Using this census data, the total value of residential structures in Granite County can be estimated at $162,394,200 (2,074 housing units * $78,300/unit). Breaking down the different jurisdictions in Granite County, the value of the building stock in Philipsburg is estimated at $36,077,800, in Drummond at $9,821,200, and in unincorporated areas of Granite County at $116,494,804.

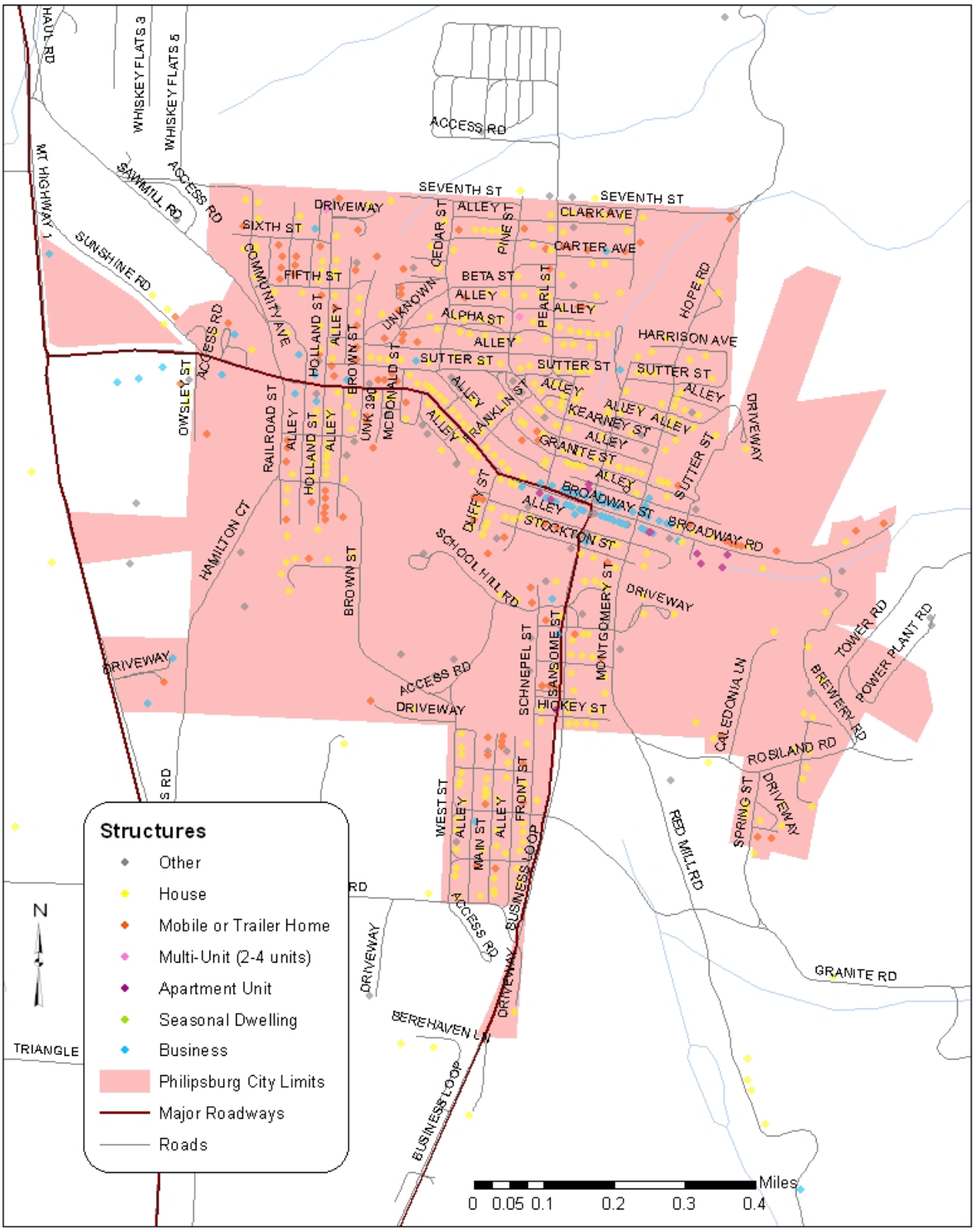
Granite County has recently initiated the development of a detailed Geographic Information System for 911 use and rural addressing. This data identifies the locations of all of the structures in the county. Although this data has yet to be implemented for 911 and is still undergoing development, nearly all of the structures and roads in the county have been mapped. This dataset contains 2,735 structures and roughly 315 miles of roadways within Granite County. This data was used to compare structure locations to hazard areas in the vulnerability assessment. Maps 4.9 through 4.12 show the structure locations in Granite County, Philipsburg, Drummond, and the Georgetown Lake area, and Maps 4.13 through 4.15 show the distribution of single family houses, mobile and trailer homes, and seasonal dwellings.

Map 4.9 Structures in Granite County, Montana



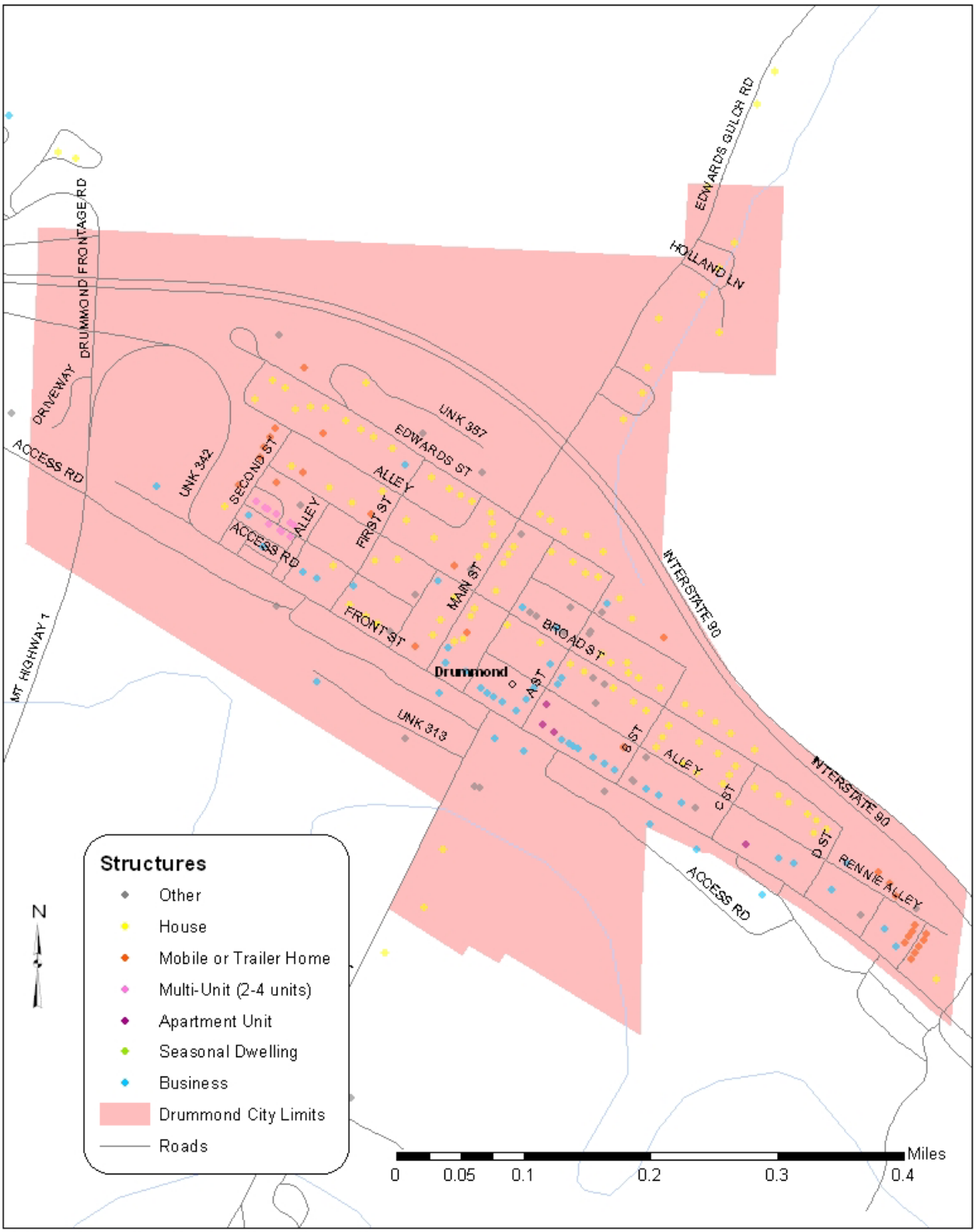
Data Sources: Montana State Library
MaPS, Inc. under contract by Granite County

Map 4.10 Structures in Philipsburg, Montana



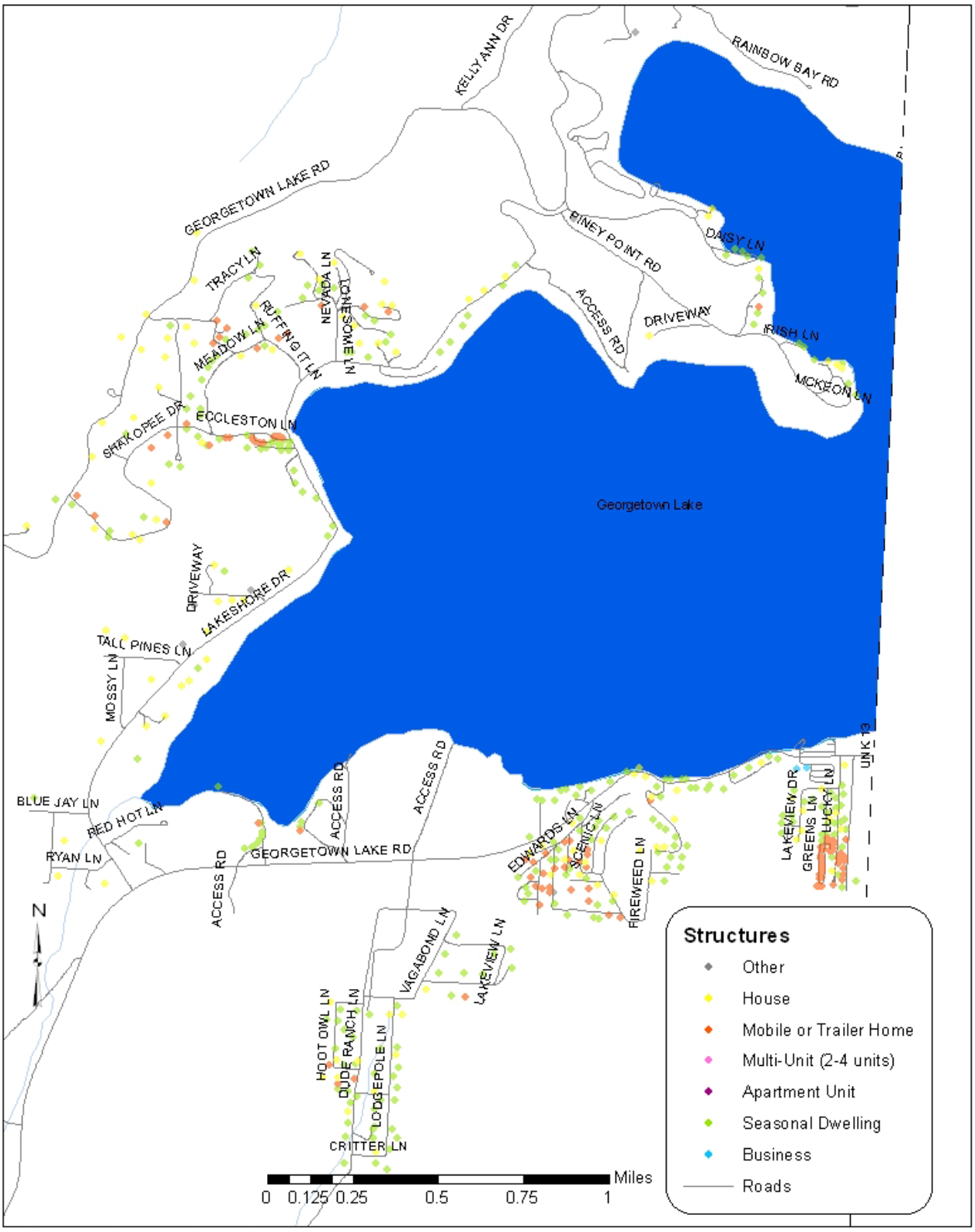
Data Sources: Montana State Library
MaPS, Inc. under contract by Granite County

Map 4.11 Structures in Drummond, Montana



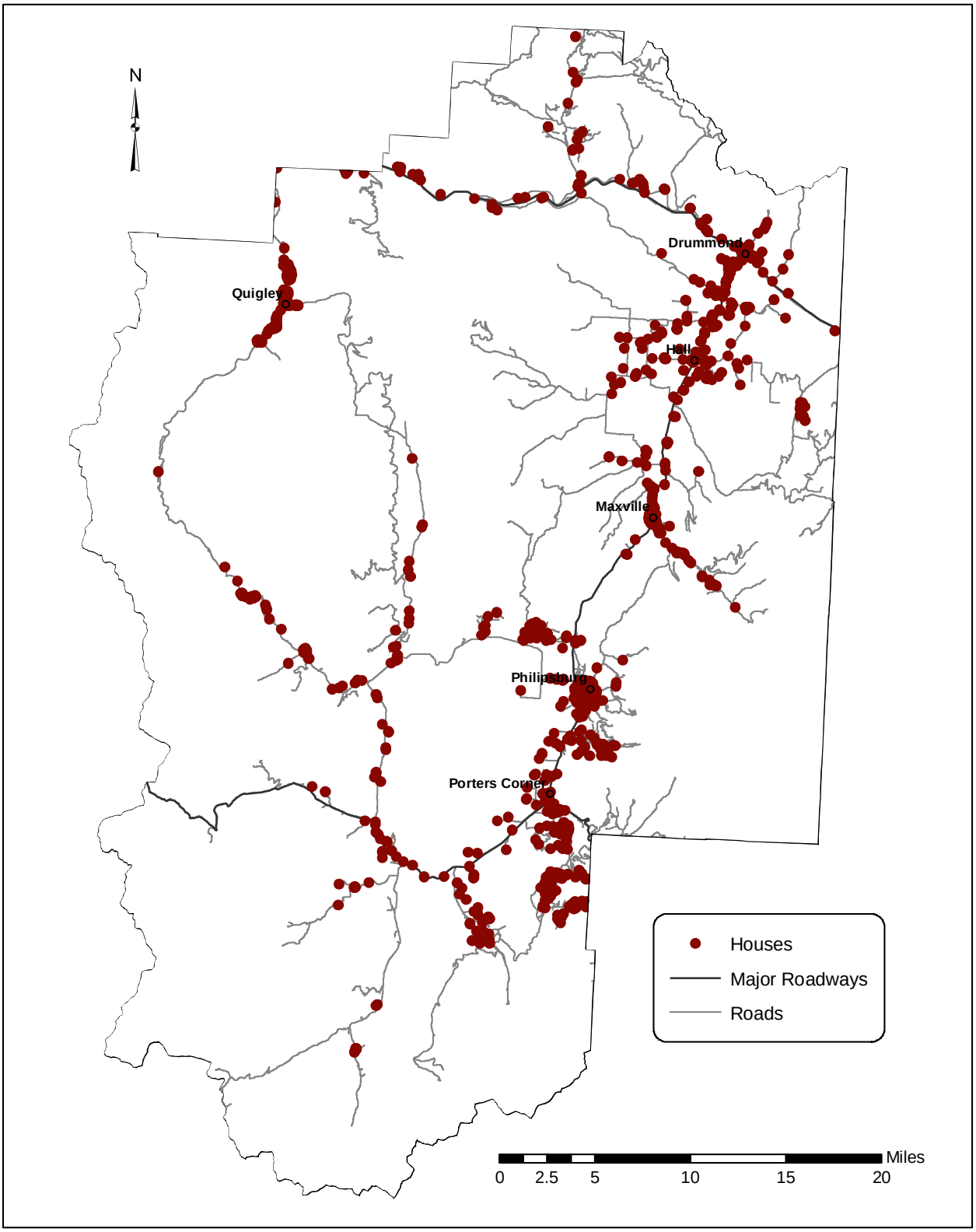
Data Sources: Montana State Library
MaPS, Inc. under contract by Granite County

Map 4.12 Structures in the Georgetown Lake Area, Granite County, Montana



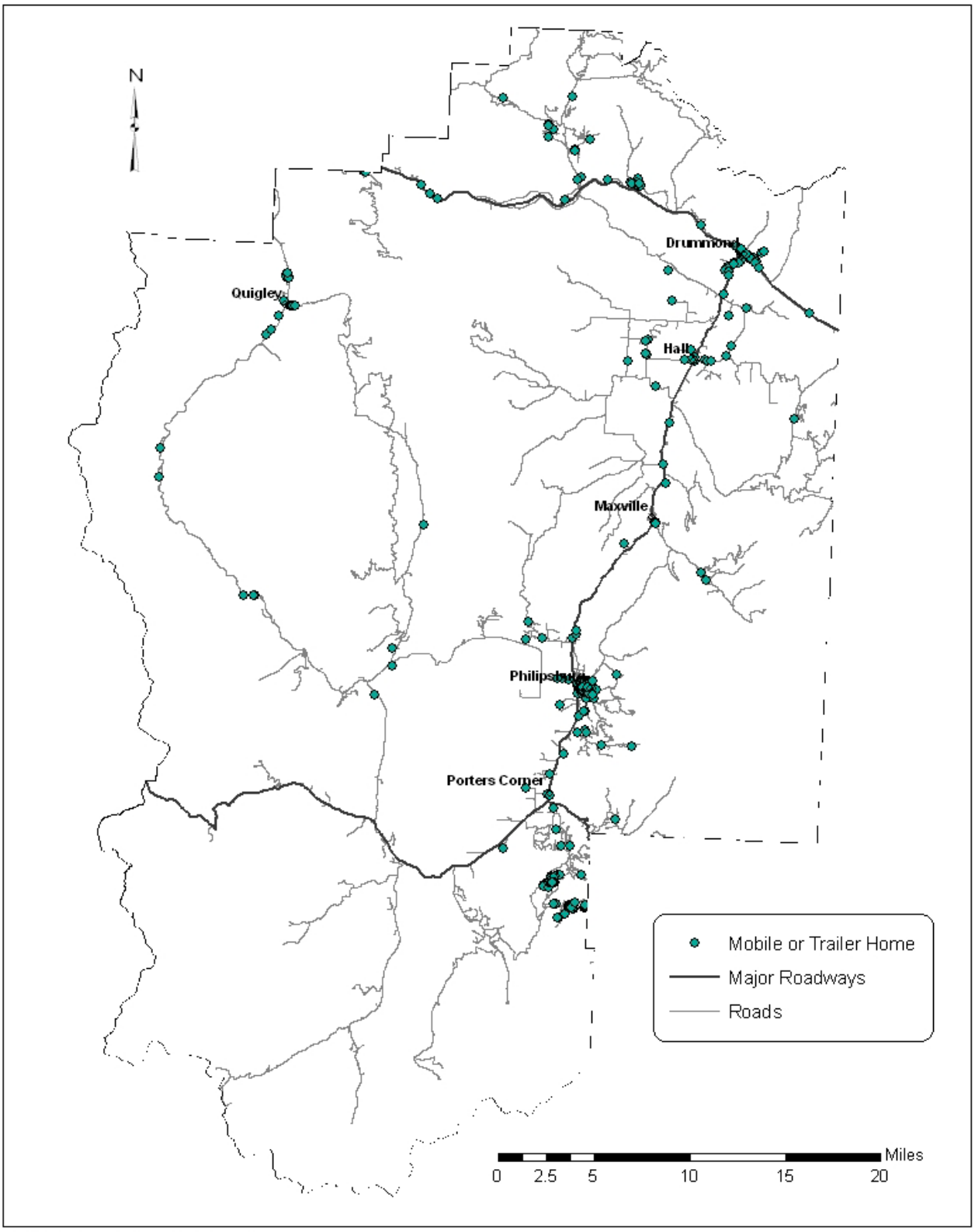
Data Sources: Montana State Library
MaPS, Inc. under contract by Granite County

Map 4.13 Single Family Houses in Granite County, Montana



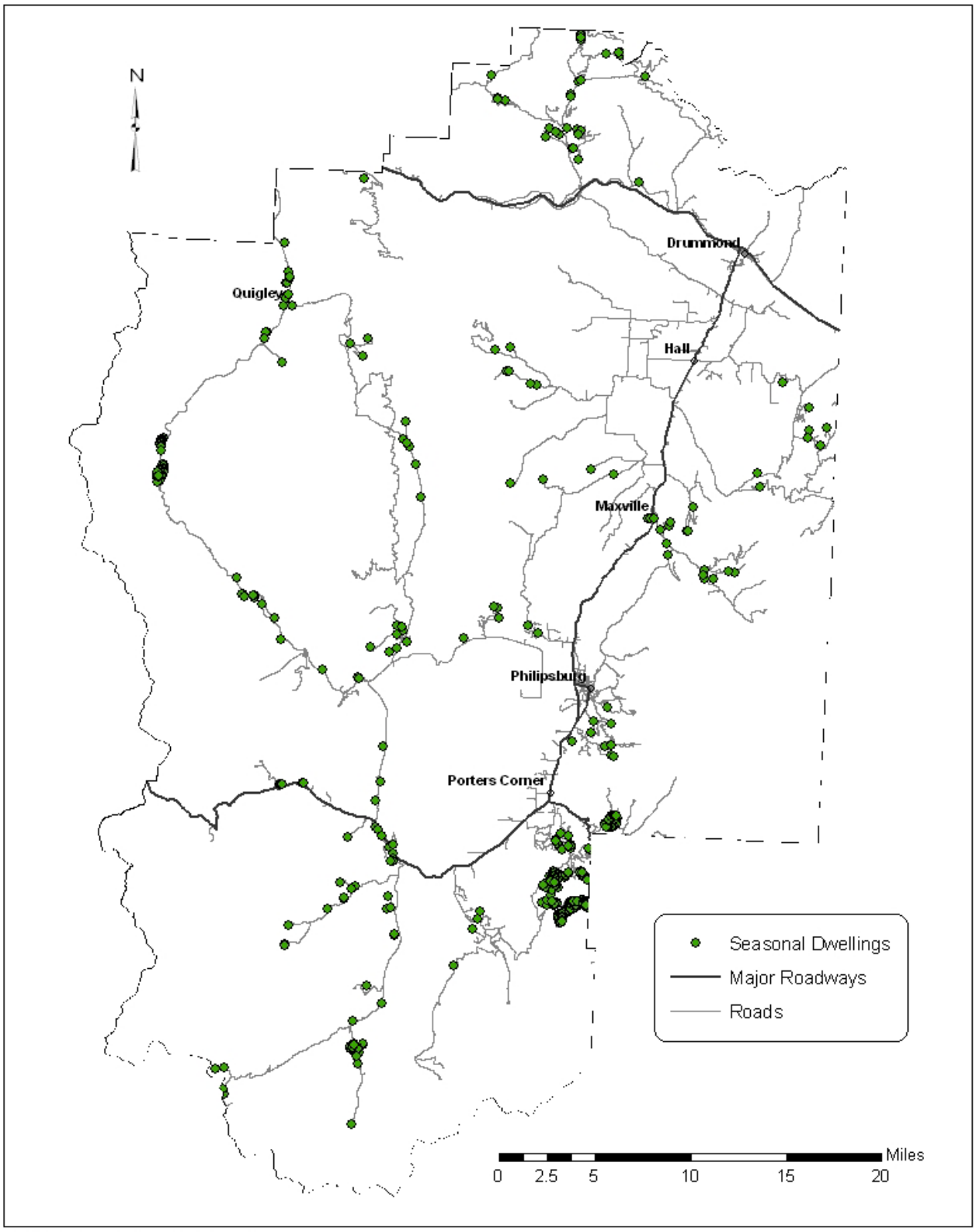
Data Sources: Montana State Library
MaPS, Inc. under contract by Granite County

Map 4.14 Mobile and Trailer Homes in Granite County, Montana



Data Sources: Montana State Library
MaPS, Inc. under contract by Granite County

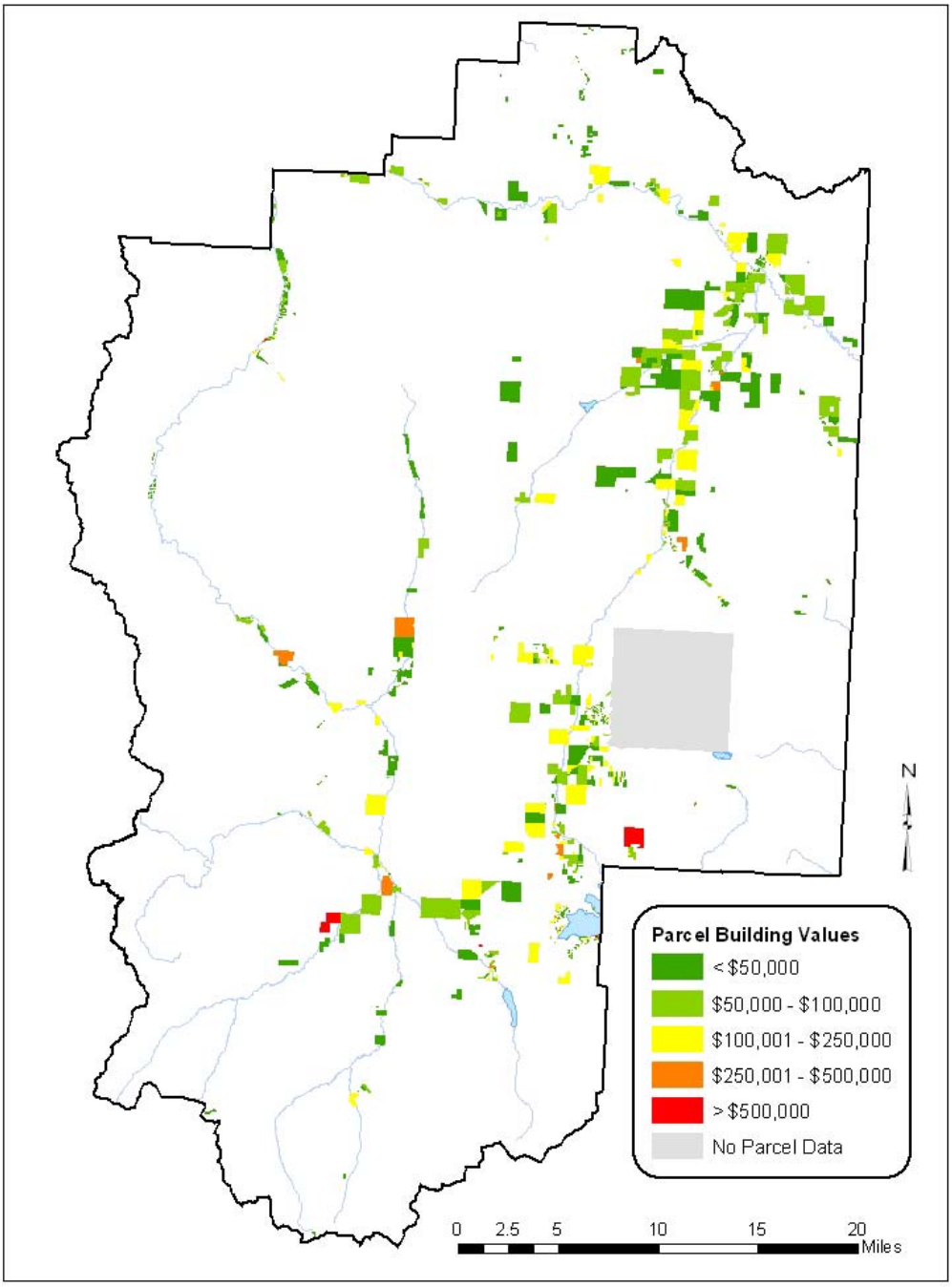
Map 4.15 Seasonal Dwellings in Granite County, Montana



Data Sources: Montana State Library
MaPS, Inc. under contract by Granite County

Another database available to Granite County is the Montana Department of Revenue Computer Assisted Mass Appraisal System (CAMA). This database shows the parcels of land and the associated taxable land and building values. Map 4.16 shows the 1,825 parcels with building values greater than $0. Note that an area east of Philipsburg is missing from this database. The sum of the structure values (not including land values) assessed in Granite County is $103,697,663. In comparison, the Federal Emergency Management Agency's HAZUS-MH loss estimation software gives the building stock in Granite County a replacement value of $235,000,000.

Map 4.16 Granite County Land Parcels with Taxable Structures

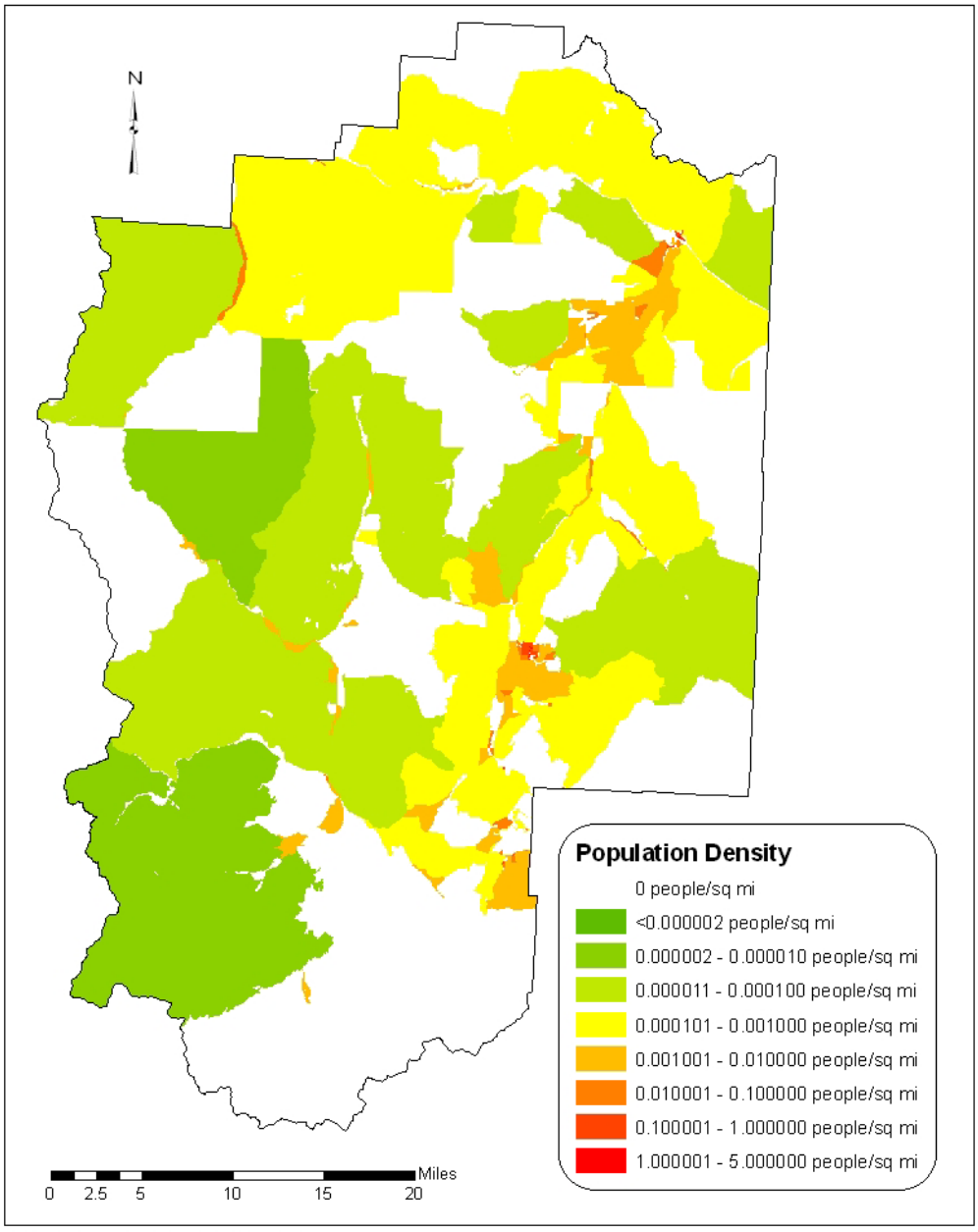


Data Source: Montana Department of Revenue Computer Assisted Mass Appraisal (CAMA) Database 2004

Population

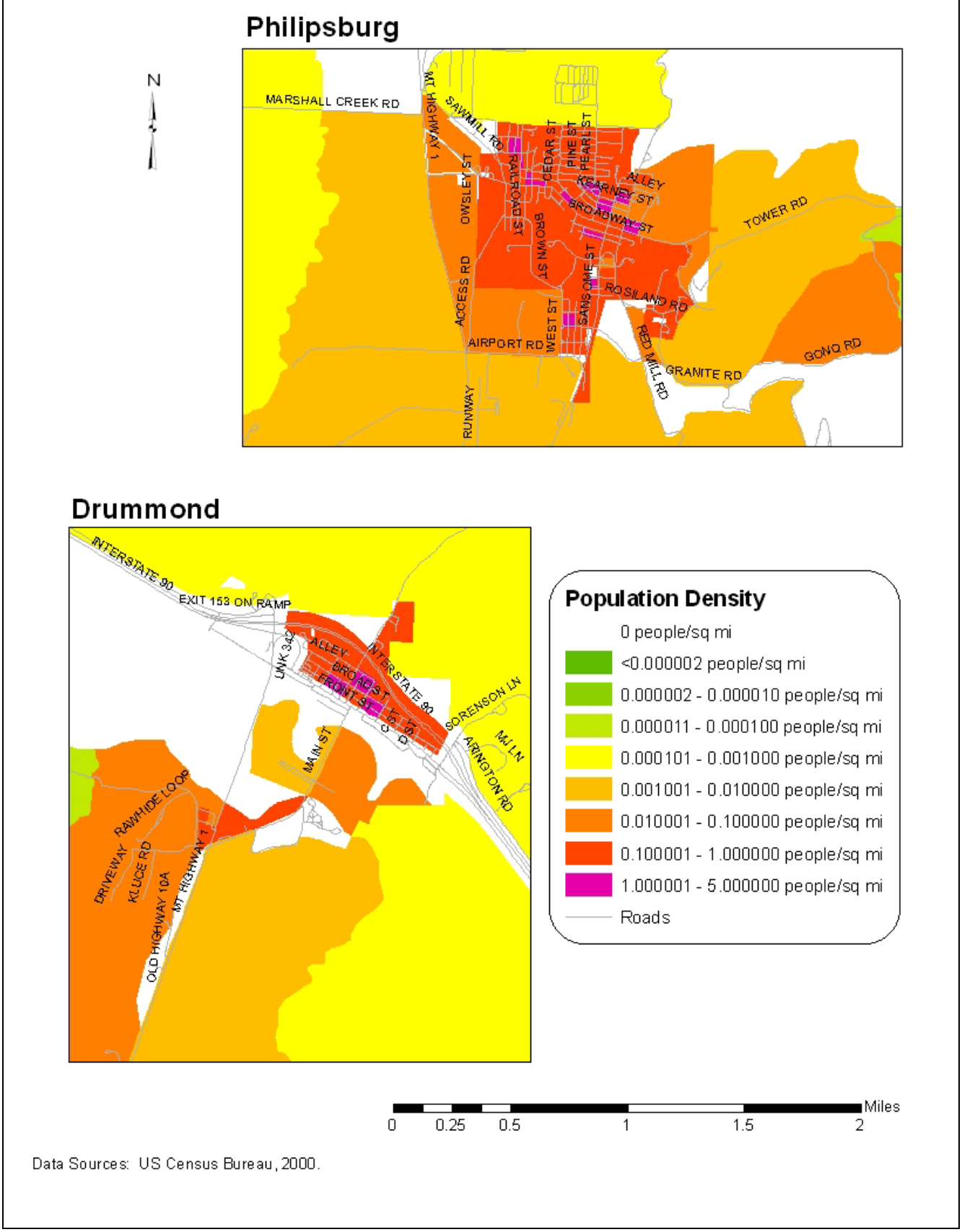
US Census data defines the 2000 population of Granite County as 2,830 people. Of that population, 914 people live within the Town of Philipsburg and 318 people live within the Town of Drummond. The median age of 42.8 years in Granite County is significantly older than the statewide median age of 37.5 years. According to 2000 US Census data, 15.9% of the residents, or 450 people, are 65 years old or older, compared to the state figure of 13.4%. Therefore, Granite County has a greater elderly and special needs population by percentage than other parts of the state. At the same time, the county has a slightly lower percentage of children under the age of 18 at 24.2%, compared to the state average of 25.5%. Maps 4.17 and 4.18 show the population density by census block based on 2000 Census Data.

Map 4.17 Population Density by Census Block for Granite County, Montana



Data Sources: US Census Bureau, 2000.

Map 4.18 Population Density by Census Block in Philipsburg and Drummond, Montana



Data Sources: US Census Bureau, 2000.

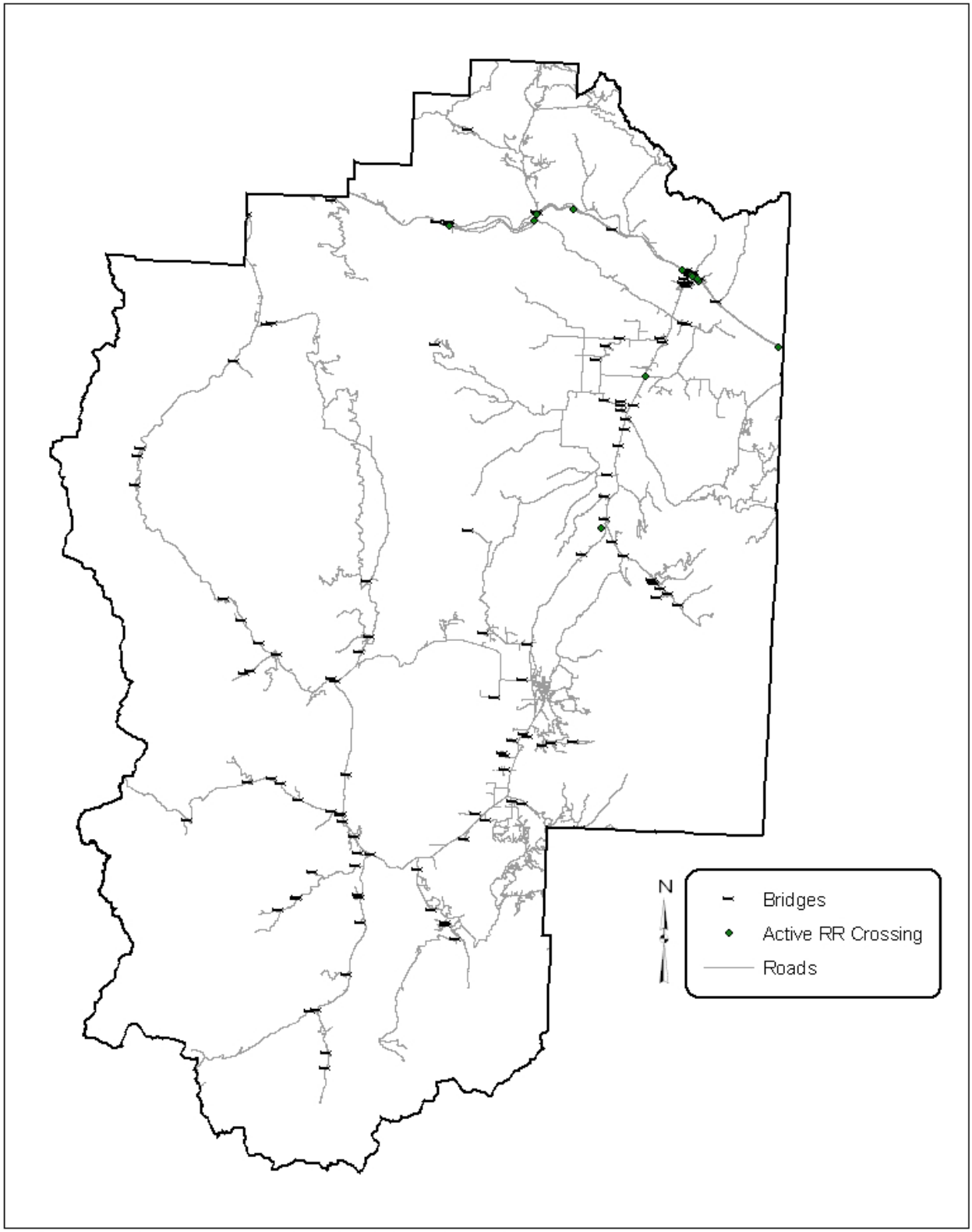
Infrastructure

Significant infrastructure supporting area communities and the northwest United States exist throughout Granite County. Most residents receive their electricity and natural gas from Northwestern Energy, except the Lower Rock Creek area that receives electricity from Missoula Electric Cooperative. The Granite County Growth Policy Plan states that 42% of homes in the county are heated with natural gas, 24% with wood stoves, and 21% with propane, kerosene, or fuel oil. Five major regional electric transmission lines cross through Granite County, one through the extreme northeast corner of the county, three close to Interstate 90, and one dipping south of Interstate 90 to near Maxville. The Yellowstone Pipeline, a major pipeline transporting refined petroleum products from Billings, Montana to Spokane, Washington crosses the northern half of the county close to Interstate 90. Telephone services in the county are provided by Blackfoot Telephone Cooperative. Several cellular telephone towers are also present and are owned by various entities. For security purposes, mapping of the electric, communications, and natural gas infrastructure is not provided.

The major roadways crossing Granite County are paved. County roads and some in Philipsburg and Drummond are often gravel. According to the Granite County Growth Policy Plan, the county maintains 540 miles of county roads, Philipsburg maintains 16 miles of streets and alleys, and Drummond maintains 4 miles of streets and alleys. Figure 4.19 shows the roads, bridges, and railroad crossings in the county.

Philipsburg is served by a public water system fed from Fred Burr Lake and Silver Springs. The number of users on this chlorinated system total 530. The system has 2 storage tanks that can hold 200,000 gallons each. Energy is also produced by the water supply system through two hydrogenerators that supply electricity for 13 government users. Philipsburg also has a gravity flow sewer system for the 530 users with 2 cell facultative lagoons. Drummond has a 200 user sewer system with a 1 cell facultative lagoon. Buildings in the more rural parts of the county are often served by individual wells and septic systems.

Figure 4.19 Granite County Roads, Bridges, and Railroad Crossings



Data Source: MaPS, Inc. under contract by Granite County

Economy

For many years, the Granite County economy was driven by the mining industry and stabilized by the agricultural and logging economies. Today, the economy is a bit more diversified. Table 4.20 shows the 1997 Economic Census data for Granite County. Table 4.21 shows the personal income earnings by industry.

Table 4.20 1997 Economic Census Data for Granite County, Montana[3]

Description	Number of Establishments	Sales, Receipts, or Shipments
Retail trade	44	$14,010,000
Wholesale trade	3+	$3,604,000+
Forestry, fishing, hunting, and agricultural support services	50+	$2,027,000+
Accommodation & food services	15+	$1,792,000+
Manufacturing	23+	$902,000+
Construction	35+	$828,000+
Other services (except public administration)	38+	$801,000+
Professional, scientific, and technical services	24+	$779,000+
Transportation and warehousing	13+	$671,000+
Real estate, rental, and leasing	22	$332,000+
Health care and social assistance	13	$59,000+
Arts, entertainment, and recreation	D	D
Administrative, support, waste management, and remediation services	D	D
Mining	D	D
Utilities	D	D
Finance and insurance	D	D
Educational services	D	D
Estimated TOTAL		$25,805,000

D = Withheld to avoid disclosure
N = Not available
+ = Plus additional businesses withheld to avoid disclosure, businesses of out-of-scope industries, or not available

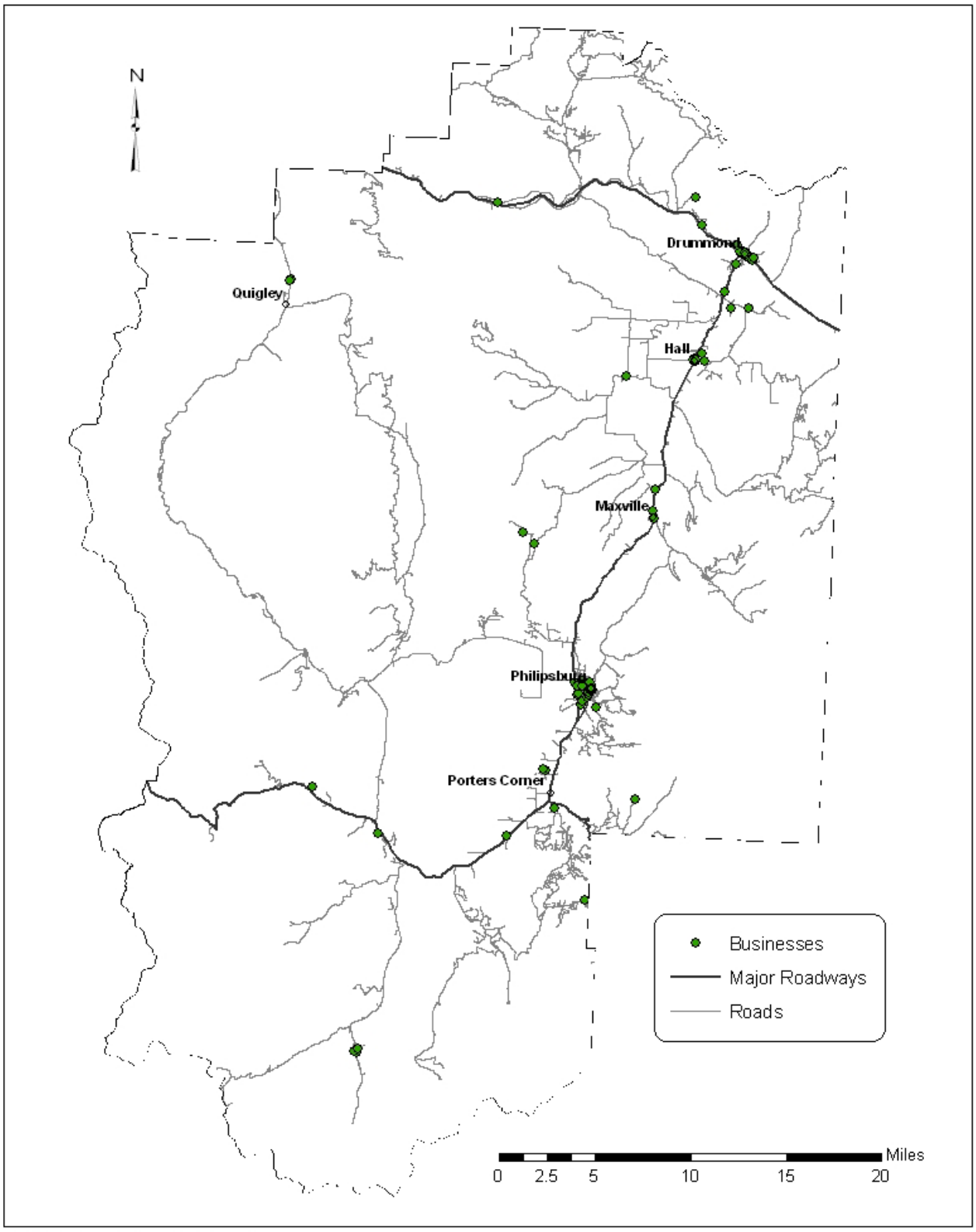
Table 4.21 Personal Income Earnings by Industry for Granite County, Montana in 2000[4]

Industry	Earnings
Local Government	$4,890,000
Manufacturing	$4,040,000
General Construction	$3,040,000
Services	$2,960,000
Federal Government	$2,550,000
Transportation, Communications, Public Utilities	$2,170,000
Retail Trade	$2,160,000
Mining	$1,400,000
Agriculture	$1,210,000
Finance, Insurance, Real Estate	$925,000
Agricultural Services	$750,000
Travel/tourism	$655,000
Wholesale	$650,000
State Government	$540,000
Heavy Construction	$235,000

Map 4.22 shows the business distribution and locations in the county.

[4] Jim E. Richard, Business Services, Inc. and Granite County Planning Board. Draft Granite County Growth Policy Plan. 2004.

Map 4.22 Business Locations in Granite County, Montana



Data Sources: Montana State Library
MaPS, Inc. under contract by Granite County

Land Use and Future Development

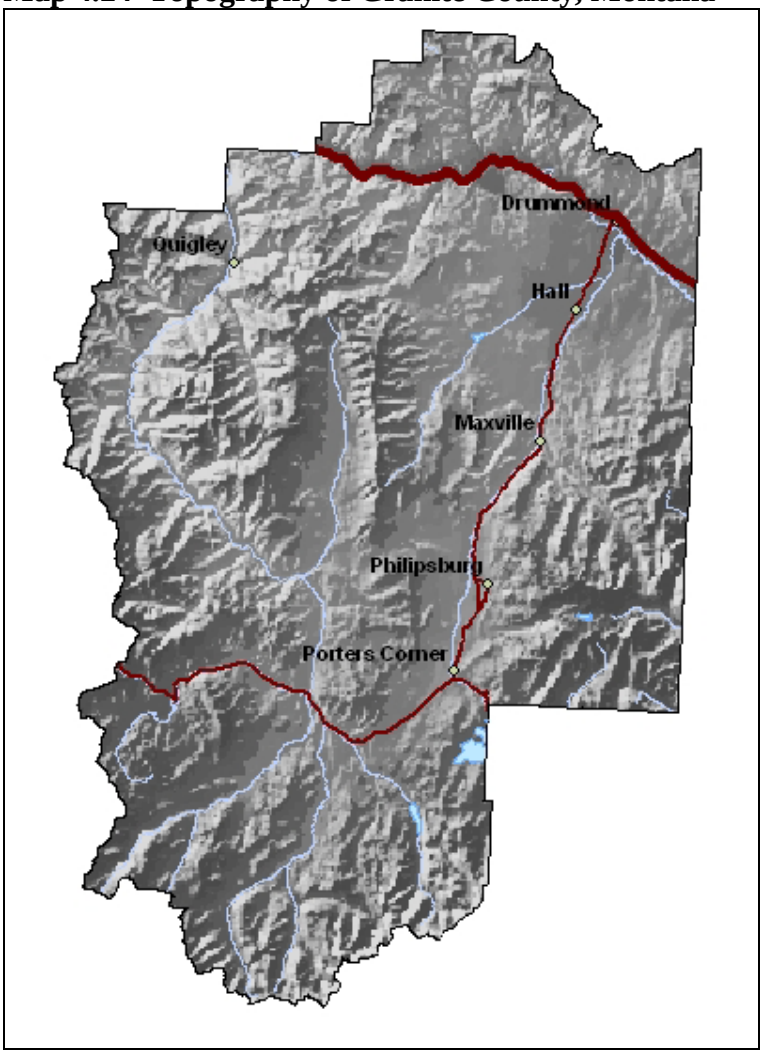
Granite County, located in western Montana, has been considered a rural area for many years, but as the surrounding areas continue to grow rapidly, Granite County is expected to experience more development. Table 4.23 shows the projected population growth over the next five years. Currently, most of the growth in the county is occurring in the Georgetown Lake area with other smaller pockets throughout the county.

Table 4.23 Projected Population[4]

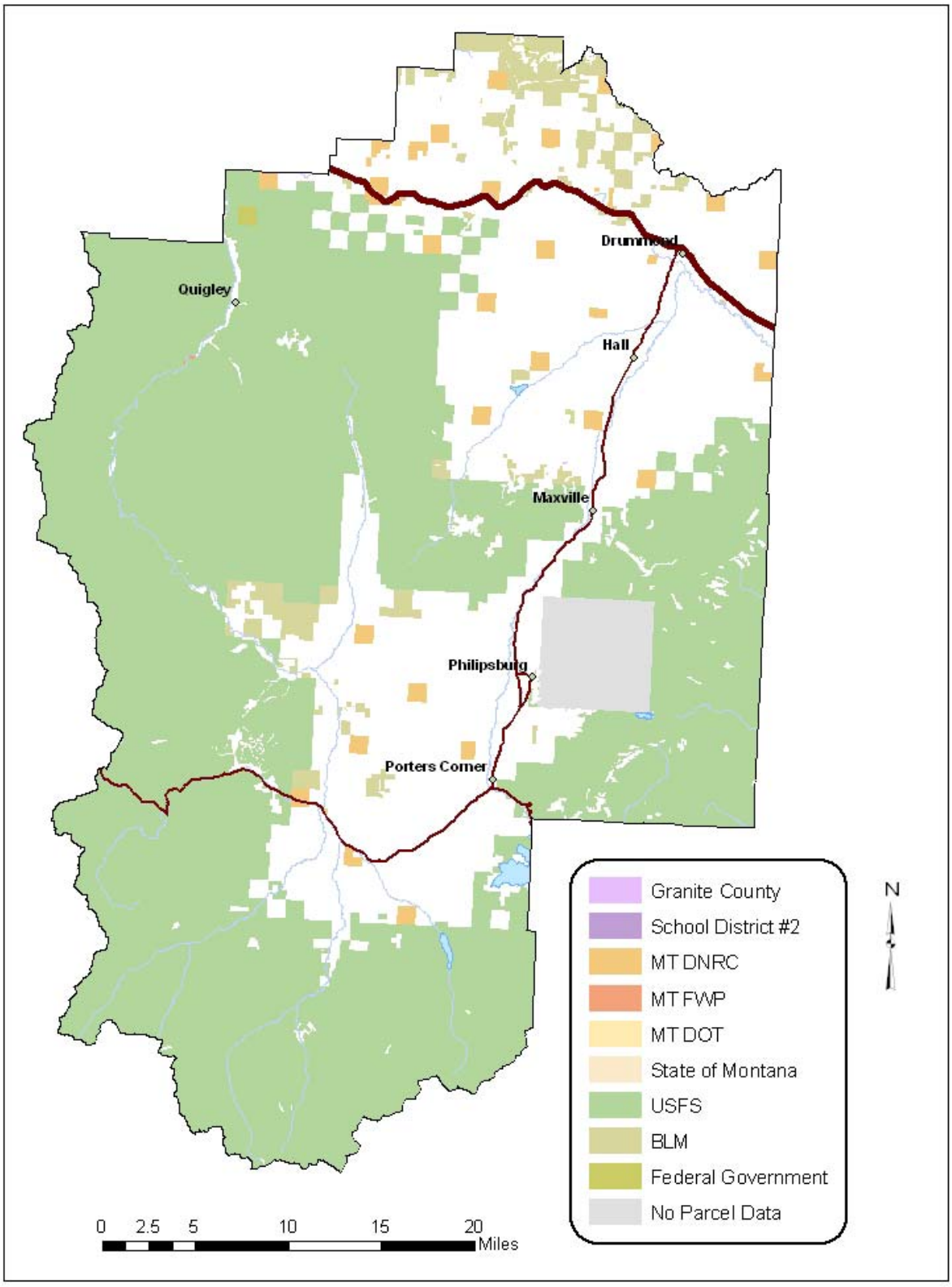
Year	Population
2000	2,830
2005	3,000
2010	3,200

Map 4.24 shows the topography, major roadways, and communities in Granite County. Map 4.25 shows the federal, state, and local government owned lands. Map 4.26 then shows the land uses and Table 4.27 lists the assessed value of taxable property in the county by major classes.

Map 4.24 Topography of Granite County, Montana

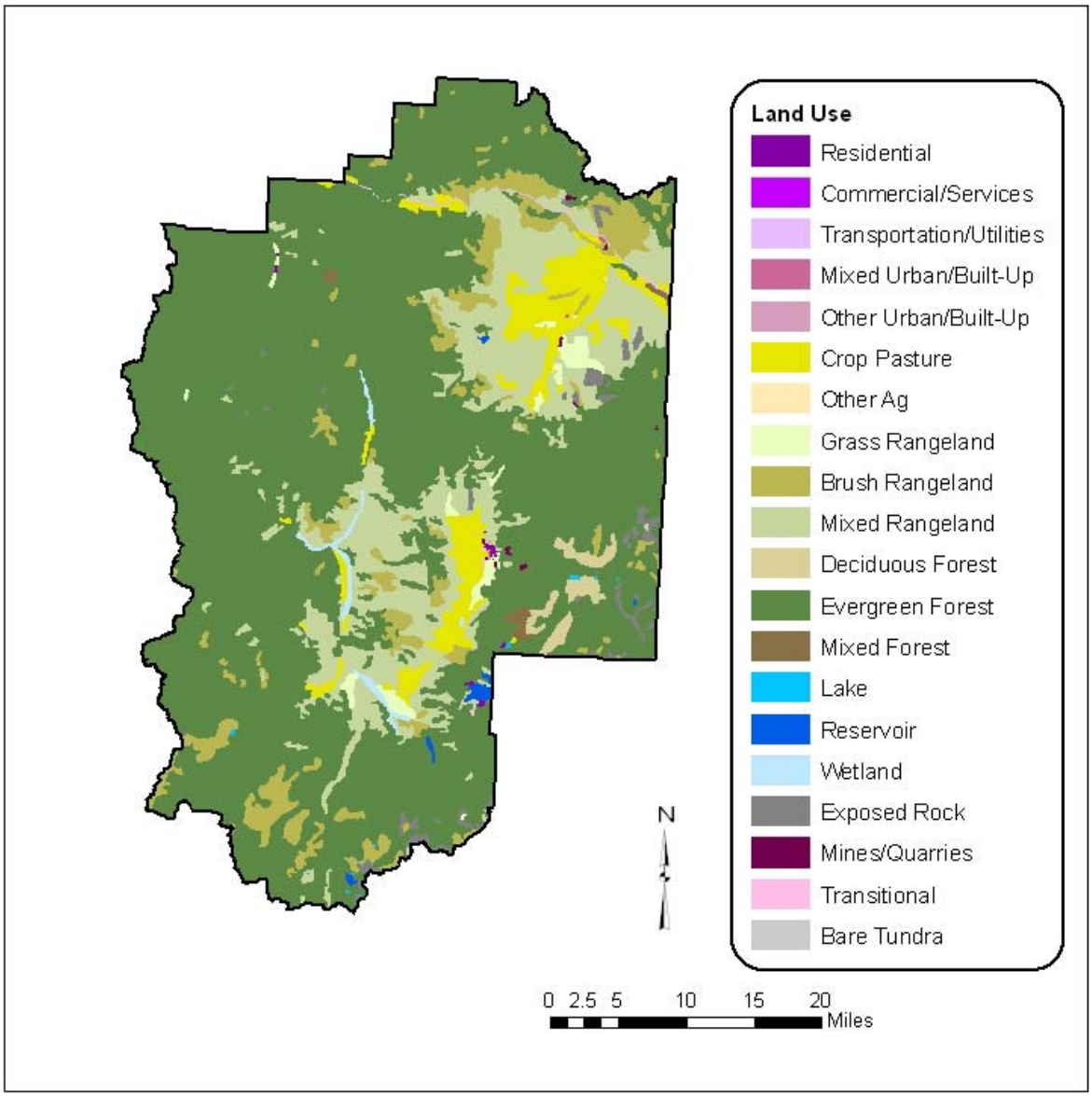


Map 4.25 Government Lands in Granite County, Montana



Data Source: Montana Department of Revenue Computer Assisted Mass Appraisal (CAMA) Database 2004

Map 4.26 Land Use in Granite County, Montana



Data Source: Montana Department of Revenue Computer Assisted Mass Appraisal (CAMA) Database 2004

Table 4.27 Major Classes of Taxable Property and Assessed Values in 2000[4]

Class	Assessed Value
Residential	$74,606,000
Timberland	$56,158,000
Agricultural	$25,950,000
Utilities	$23,558,000
Commercial/Industrial	$21,400,000
Railroad	$17,480,000
Telecommunications	$7,263,000

Granite County is in the process of developing a Growth Policy Plan and a Capital Improvements Plan to manage growth. The Growth Policy Plan is currently in draft form, dated January 15, 2004. The Capital Improvements Plan has been funded but has not been developed.

Granite County Growth Policy Plan, Draft[4]

The Granite County Growth Policy Plan is being developed to meet the requirements of state law before any additions or changes to subdivision regulations or zoning can be made. This planning initiative featured a county-wide citizens' survey and numerous public meetings. The survey showed "strong support for the county adopting policies, even regulations to ensure that new growth is orderly and to protect productive agricultural land. However, many citizens in the public meetings expressed concern that private property rights be protected." According to this plan, the County Planning Board encourages "the formation of localized planning and zoning districts, rather than pursuing county-wide land use regulations." The survey also shows that 60% of residents agreed that new growth should not develop adjacent to rivers, streams, or lakes.

The "Issues, Opportunities and Concerns" section of the Growth Policy Plan identifies opportunities to create wildfire mitigation requirements for new subdivisions and to keep commercial and industrial sites out of the floodplain and high fire risk areas. Further supporting hazard mitigation, the Growth Policy Plan contains the following goals and policies:

Goal: Protect the rivers and streams, flood areas, riparian areas, and wetlands in the county.

Policies:

- Prohibit development in areas deemed to be flood hazard areas.
- For new development, including subdivisions approved under Granite County Subdivision Regulations, all non-agricultural structures should be set back 300 horizontal feet from the high water marks of streams and irrigation canals and ditches. Variances may be granted in certain topography.

Goal: Ensure the effectiveness of fire fighting in all of Granite County, minimize damage to property and risk of death and injury, and provide maximum safety for fire fighters, EMS, and law enforcement personnel through sound design of new development.

Goal: Minimize exposure within wildland/urban interface and other high fire hazard areas.

Policies: The Granite County Subdivision Regulations will provide special requirements to ensure effective fire fighting, reduce fire damage, and safety in all new subdivisions proposed in high fire hazard areas. Proposed ideas include:

- Minimum standards for roads, bridges, culverts, and turnarounds.
- Minimum standards for water supplies.
- Encouragement of development in low fire hazard areas
- Distribution of information to new homeowners on defensible space, electric wiring, chimneys, fireplaces, etc.
- Adoption of the Granite County Fire Protection Plan and Capital Improvements Plan
- Recruitment of volunteer firefighters
- Exploration of a fire district in the Lower Rock Creek area.

The Growth Policy Plan states that new subdivision regulations will be developed upon adoption of this policy. A date for adoption of the Granite County Growth Policy Plan has not been set.

Subdivision Regulations for Granite County, Town of Philipsburg, and Town of Drummond[5]

The countywide Subdivision Regulations include the incorporated communities of Philipsburg and Drummond and all unincorporated parts of the county. Staff for the review of subdivisions is provided by the Anaconda-Deer Lodge County Planning Office per a 2004 agreement. To support state law, twelve "purposes" are promoted, one of which is:

The avoidance of danger or injury by reason of natural hazard or the lack of water, drainage, access, transportation or other public services.

Section I-J emphases the ability of the governing body to require subdividers to mitigate "potentially significant adverse impacts." During the review process of both major and minor subdivisions, the planning board must consider "relevant evidence relating to the public health, safety, and welfare." (II-B-3)

Lands unsuitable for subdivision include potential hazard areas from "flooding, snow avalanches, rock falls, land slides, steep slopes in excess of 25 percent slope, high potential for wildfire, subsidence, high water table, polluted or non-potable water supply, high voltage lines, high pressure gas lines, aircraft or vehicular traffic hazards or congestion, or severe toxic or hazardous waste exposure… or other features which may be detrimental to the health, safety, or general welfare of existing or future residents.." (IV-A-3)

Specific to flooding, land in the floodway cannot be subdivided, however, land in the flood fringe may be according to state and federal floodplain regulations. (IV-A-4) Drainage systems must be designed by a licensed engineer and certified to accommodate a 25-year storm event. (IV-A-9)

Specific to wind and heavy snow hazards, utilities must be placed underground, wherever practical. (IV-A-13)

Specific to wildfires, the regulations require two entrance/exit roads and bridges must conform to the Granite County Bridge Standards. Structures are prohibited on slopes greater than 25% and on specific topographical features ("fire chimneys"). The minimum lot sizes are shown in Table 4.28.

Table 4.28 Wildfire Minimum Lot Sizes

% Slope	Open Grass	Forest & Brush
0-10	1 acre	2 acres
10-20	2 acres	3 acres
20-25	3 acres	4 acres
Over 25	5 acres	Not permitted

[5] Granite County Planning Board. Subdivision Regulations: Granite County, Town of Philipsburg, Town of Drummond. April 2002.

Subdivisions must also meet the water supply requirements set forth by the local fire protection authority or as stated in Section IV-A-16:

- A central water system with a minimum flow of:
  - 500 gallons/minute for densities of 2 homes/acre or less
  - 750 gallons/minute for densities of 2 homes/acre or more

- With no central water system:
  - Cisterns, reservoirs, or fill ponds with a minimum storage capacity of 2,500 gallons per residence.

- Both supplies must:
  - Be within 10 feet of fire truck access
  - Provide a dry hydrant or an electric pump with a reliable backup generator

In areas considered to be high fire hazard areas by the local fire protection authority, US Forest Service, or Montana Department of Natural Resources and Conservation, the subdivision must additionally meet the following requirements as stated in Section IV-A-17:

- Road right of way shall be cleared of slash
- Open space, park land and recreation areas (including green belts, riding or hiking trails) should be located, where appropriate, to separate residences and other buildings from densely forested areas.
- Densities in areas of steep slopes or dense forest growth shall be reduced through minimum lot standards as follows in Table 4.29.

Table 4.29 High Fire Hazard Area Densities

% Slope	Open Grass	Forest & Brush
0-10	1 acre	2 acres
10-20	2 acres	3 acres
20-25	3 acres	4 acres
Over 25	5 acres	Not permitted, unless specifically authorized by Granite County

The "Suggested Findings of Fact that Weigh Review Criteria" that is issued by the Planning Board include the "Effect on Public Health and Safety" and reviewers must decide:

1a. "Based on available information, the subdivision does not appear to be subject to potential natural hazards such as flooding, snow or rock slides, high winds, wildfire or excessive slopes, nor potential man-made hazards such as high voltage power lines, high pressure gas lines, nearby industrial or mining activity, or high traffic volumes." OR "The subdivision is subject to potential hazard from flooding, snow or rock slides, high winds, wildfire, excessive slopes, high voltage power lines, high pressure gas lines, nearby industrial or mining activity, or high traffic volumes. The subdivider has committed to minimize the effect of the hazards by: _____."

Vulnerability Assessment Methodology

The vulnerability assessment was conducted using a combination of GIS analysis techniques and estimations. While some hazards have digital data depicting the degree of risk across the countywide area, others do not. Where possible, the digital data was used. Otherwise, a plausible scenario was created, and based on community values, potential losses were estimated.

Granite County is currently developing an Enhanced 911 system. A piece of this project is creating digital data and addresses for all of the structures in the county. This data is not entirely complete and has not been implemented as of yet, however, the majority of the structures in the county have been mapped. Therefore, the structure data and road data were used to create a base map for the vulnerability assessment. From this data, layers for critical facilities and other community values were created for further analysis.

For hazards with digital risk data, the hazard area was overlaid on the structure data to determine an estimated number of structures or critical facilities within that hazard area. US Census data was used to estimate the structure values exposed to the hazard. In most cases, the total dollar exposure was multiplied by a damage factor since many events will not result in a complete loss of all structures. Frequently, only parts of the hazard area are affected or structures don't suffer a complete loss and may have only minor damage. These figures, of course, will only represent estimates but are based on current hazard and exposure data. Whenever possible, losses were estimated based on factors listed in the FEMA *State and Local Mitigation Planning How-to Guide: Understanding Your Risks*[6].

The population impacts were qualitatively assessed based on the percentage of the population estimated to be in the hazard area and the general warning time that could be expected. The number of structures in the hazard area were multiplied by 1.03 people/structure (2,830 county population / 2,735 county structures) to derive an estimate of the population in the affected area. In general, the loss of life and possible injuries are difficult to determine and would be dependent on the time of day, event location, and hazard specific circumstances. Infrastructure was also qualitatively assessed based on the type of hazard and the probable damages in an event.

The vulnerability of future development was determined through a comparison of the high risk areas for each hazard and the expected growth for those areas. Resources, such as the county growth policy plan, subdivision regulations, and population estimates were used where possible. The impact of future development was also determined based on the ability to mitigate damages during the planning and construction phases of the development and the community provisions in place to do so.

[6] Federal Emergency Management Agency. Understanding Your Risks: Identifying Hazards and Estimating Losses. FEMA 386-2. August 2001.

Hazard Profiles

AVALANCHE and LANDSLIDE

Description

Avalanches and landslides are similar in nature such that both occur when a material on the surface of the earth cannot be supported any longer and gives way to gravity. In the case of an avalanche, the substance is snow, and for a landslide, the substance is mud, rock, or other geologic material. Both can occur rapidly with little warning.

When snow accumulations on a slope cannot be supported any longer, the snow support structure may break and fall creating an avalanche. The subsequent rush of unsupported snow can bury and move things in its path. The majority of avalanches do not cause any damage; occasionally however, people and property may fall in their paths.

According to the Montana Disaster and Emergency Services website, "If it is assumed that an accumulation of snow is possible anywhere in Montana, then we can evaluate the potential for hazard solely on the basis of terrain characteristics. The most important factor by far is terrain steepness. Wet snow avalanches can start on slopes of 20 degrees or less, but the optimum slope angle for avalanche starting zones is 25-45 degrees. Slopes steeper than 45 degrees will not normally retain enough snow to generate large avalanches, but they may produce small sluffs that trigger major avalanches on the slopes below. Therefore, all slopes of 20 degrees and greater should be considered as potential avalanche sites."[7]

In the case of landslides, some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide movement include: saturation by water, steepening of slopes by erosion or construction, alternate freezing or thawing, earthquake shaking, and volcanic eruptions. Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides.[8]

History

Granite County has a history of both avalanches and landslides. Table 4.30 outlines the impacts of avalanches since 1998. Note that avalanches regularly occur in Granite County but typically do not cause any damages. The only concerns here are when people or property lie in the path.

[7] Montana Disaster and Emergency Services. http://discoveringmontana.com/dma/des/.
[8] Federal Emergency Management Agency. www.fema.gov.

Table 4.30 Granite County Avalanches Impacting the Population 1998-2003[9]

Date and Location	Result
January 3, 1998 Southeast of Hamilton near Granite/Ravalli border near Shadow Lake	Three snowmobilers trapped, one killed
December 26, 2000 Closed area of Discovery Basin Ski Area near Georgetown Lake	Three teenagers injured
December 21, 2001 13 miles East of Philipsburg near Thompson Lake in Flint Creek Range	One 21 year old male killed when separated from party

Although specific dates and damages are not known, significant landslides have occurred in Granite County. Montana Department of Transportation studied the Flint Creek Landslide Complex between mileposts 27.8 and 28.5 on Highway 1 near Georgetown Lake and the Deer Lodge County line. This area was closed for two days following a slide in this area in the early 2000's. Despite the numerous relatively minor incidents in Granite County from avalanches and landslides, none have warranted state or federal disaster declarations.

Probability

The Colorado Avalanche Information Center[10] has compiled statistics on a statewide basis on avalanche fatalities. Montana ranks fifth in the nation with over 50 fatalities from 1950/51 to 2000/01. Looking at the activities the individuals were undertaking at the time of the avalanche, climbing, backcountry skiing, and snowmobiling rank as the top three. Based on the statistics from 1998-2003, someone is killed once every 3 years (2 fatalities/6 years) in Granite County from avalanches.

Landslides have an even lower probability of creating a disaster based on a very limited history of events. Should landslides occur in this area, they typically do not affect life or private property and mostly threaten road infrastructure. The probability of a damaging landslide could greatly increase if development were to occur in landslide prone areas. Wildfire burn areas also greatly increase the probability of a landslide triggered by precipitation.

The probability of an avalanche or landslide to cause enough damage for a county, state, or federal disaster is considered low based on the historical record.

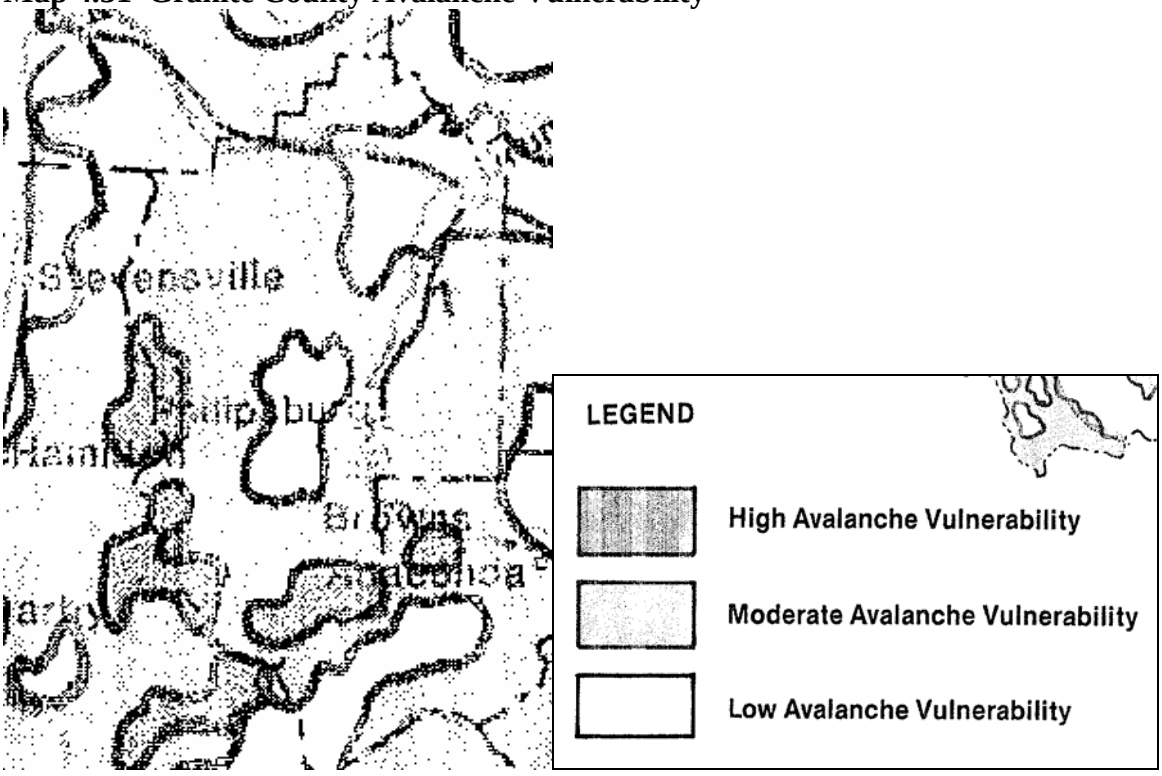
Mapping

A map titled Vulnerability to Avalanches in Montana published in the Montana Hazard/Vulnerability Analysis from 1987[11] shows the very general areas within Montana that are considered vulnerable to avalanches. Map 4.31 shows an electronically scanned version of the legend and map zoomed to Granite County. Although somewhat difficult to read, the map shows the southern and western

[9] Avalanche.org Database. 2004. www.avalanche.org.
[10] Colorado Avalanche Information Center. 2004. http://geosurvey.state.co.us/avalanche/Default.aspx?tabid=1.
[11] Montana Disaster and Emergency Services. Montana Hazard/Vulnerability Analysis. Vulnerability to Avalanche in Montana. 1987.

sections of Granite County to be at greatest risk for avalanches. These areas coincide with mountainous regions of the county.

Map 4.31 Granite County Avalanche Vulnerability[11]

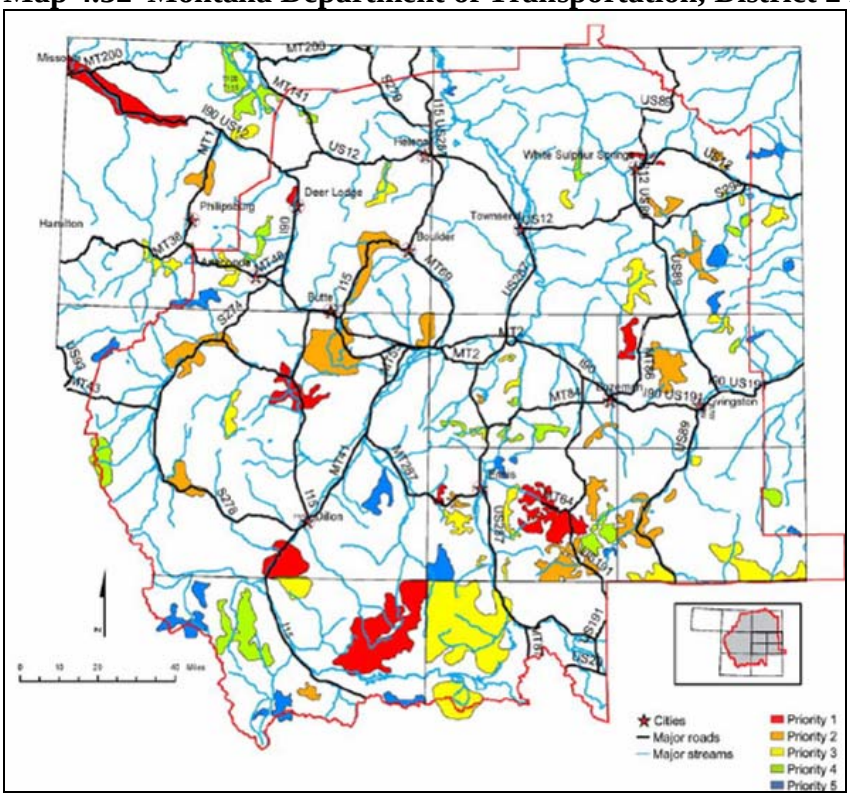


Landslides, due to their site specific nature, are a difficult hazard to map. A national map has been produced by the US Geological Survey as part of a study. This study looked at incidence and susceptibility of landslides on a nationwide basis. Therefore, the areas identified are general and are not exact on the county scale.[12] The area around Drummond is considered to have a moderate incidence and susceptibility. The remainder of the county has a low incidence and low susceptibility based on this national study. History has shown, however, that landslides have most often occurred in the Flint Creek Range.

The Montana Department of Transportation, District 2 has mapped the priority areas for landslide mitigation. The determination of priorities was based on an inventory of landslides and their proximity to state highways. Granite County, in the northwestern section of Map 4.32, just outside of District 2, shows areas of all priority levels within the county.

[12] Godt, Jonathan W. USGS Open-File Report 97-289. 1997.

Map 4.32 Montana Department of Transportation, District 2 Landslide Priority Areas[13]



Associated Hazards and Other Factors

Avalanches often occur independently from other hazards but can occasionally be linked to significant winter storms and high wind events. During years of heavy snowfall and increased incidence of avalanches, a rapid snowmelt can then lead to flooding. Landslides can be linked to several different hazards. Following a wildfire, the burnt area can often be very prone to landslides, particularly when combined with heavy rainfall. In fact, given enough rainfall, landslides and the associated mudflows can occur almost anywhere and are typically partnered with flash flooding off of mountainous areas. The massive Hebgen Lake landslide in Madison County, Montana was triggered by a strong earthquake. This potential also exists in Granite County.

Vulnerability

Critical Facilities

Critical facilities in Granite County historically have not suffered losses or been threatened by avalanches or landslides. Not that a critical facility could not be impacted, but the probability is very low. Most facilities are located outside of steep slope areas. The primary exceptions are roadways and communications equipment. Some sections of state highways and county roads are known to have possible landslide hazards, as shown in Map 4.32. Typically, communications equipment, such as radio towers, are located on mountain peaks and are somewhat protected due to their locations near the

[13] Montana Disaster and Emergency Services. State of Montana Multi-Hazard Mitigation Plan and Statewide Hazard Assessment. October 2004.

top of the slope but are not immune to avalanches and landslides. Specifically, the Granite County Sheriff's Office/911 Repeater Site is in an area known for avalanches. Potential losses to roadways and communications equipment could easily total into the hundreds of thousands of dollars, but the probability of such an event is considered low.

Potential Losses

Like critical facilities, potential losses to other structures are considered low. Most avalanche and landslide prone areas are located on federal or state lands and do not have significant numbers of structures. The potential for economic losses is more likely yet probably not significant. An avalanche or landslide could destroy an area designated for logging, however, such an event may also create fallen timber for harvesting. With tourism being a very large part of the regional economy, severe avalanche seasons could have an impact on the snowmobiling economy. Although the potential for economic losses exists, it is not considered significant.

Potential Population Impacts

Based on records from the past 6 years, an average of one person is killed by avalanches in Granite County every three years. This figure shows that the greatest losses from avalanches are to human life. The potential for population impacts from avalanches, especially when compared to other hazards, is still considered low. Related to landslides, the National Weather Service in Missoula issues flash flood warnings during periods of rainfall or snow melt that have a high likelihood of causing flash flooding. Such flooding and rapid runoff may trigger land and mud slides. Without any documentation supporting any deaths or injuries from landslides in Granite County, this potential is also considered low.

Impact of Future Development

Fortunately, most of the avalanche and landslide prone areas in Granite County are within publicly owned lands. The subdivision regulations specifically list snow and rock slide hazard areas as unsuitable for development without mitigation. Should development on private land coincide with avalanche or landslide areas, however, the impact of future development could have negative consequences on life and property.

Data Limitations

The data on avalanche and landslide hazards in Granite County is quite limited. These hazards are not expected to seriously threaten the community, and therefore, have not been studied thoroughly. The data that does is exist is either on a national, not county-wide, scale or is old and somewhat obsolete. Avalanches and landslides are such site specific events that pinpointing specific vulnerable areas is quite difficult and costly. Therefore, this hazard profile is general in nature and could be more specific if better data is ever compiled. Irregardless, individual property owners are encouraged to consider these hazards specific to their site.

COMMUNICABLE DISEASE

Description

Disease can be devastating to a community through its population or its economy. Human diseases, when on an epidemic scale, involve high infection rates in the population. Depending on the disease, quarantines and mass fatalities may result. Highly contagious diseases are the most threatening to the community, and even if the mortality rate is low in the general population, such as with influenza, the disease can be highly hazardous for the elderly, children, and those with suppressed immune systems.

Humans are not the only disease concern. Contagious animal and plant diseases could distress the agricultural community. In such a situation, food supplies and the economy would be threatened, depending on the disease and animal or plant affected. Known livestock and animal diseases such as Foot and Mouth, Chronic Wasting, Bovine Spongiform Encephalopathy (BSE or Mad Cow Disease), West Nile, and Brucellosis, among others, could have damaging effects on the livestock population.[14]

Diseases can be transported in a number of ways including naturally and intentionally. Naturally occurring diseases, some of which may not have even formed yet such as the contagious human strain of the Avian Bird Flu, could infect the population or agriculture with little notice. Others, such as influenza, may be particularly severe in any given year.

History

Diseases are a part of everyday life. When they significantly impact the population, however, actions are taken to prevent additional infection. Fortunately, notable events have not occurred in Granite County in recent history. Residents recall a whooping cough quarantine in the county about 75 years ago. The Spanish influenza outbreak after World War I in 1918-1919 caused 9.9 deaths per 1,000 people in the State of Montana.[15]

Probability

The probability of an epidemic in Granite County is rather difficult to assess based on history and current data. Medicine has improved significantly over the past 50 years and continues to do so every day. With rapid worldwide travel and the importance of tourism in Granite County, the probability of an epidemic infecting humans, animals, or plants at some point is considered moderate for this area.

Mapping

The communicable disease hazard is somewhat uniform across the county. The residential areas may be slightly more vulnerable to the rapid spread of disease in humans, however, the more rural areas are more vulnerable to animal and plant diseases. Therefore, mapping does not enhance this hazard profile.

[14] Montana Department of Livestock. http://www.discoveringmontana.com/liv/.
[15] Brainerd, Elizabeth and Mark V. Siegler. The Economic Effects of the 1918 Influenza Epidemic. June 2002.

Associated Hazards and Other Factors

Other disasters such as those that result in the loss or contamination of potable water or sanitary services may result in an increased probability of disease. Often following a large scale disaster, disease is a primary concern. The time of year and weather conditions may also be a factor in the development of an epidemic.

Vulnerability

Critical Facilities

Critical facilities are not structurally threatened by communicable disease, however, their accessibility and functionality can be lost. Contamination of a critical facility could render the facility non-functional until decontamination or the threat has passed. For this reason, all critical facilities are assumed to be at risk from communicable disease. As with any biological event, the Granite County Medical Center would most likely discover a threat and possibly become the first contaminated location.

Potential Losses

Potential losses from communicable disease, in addition to the population (discussed in the next section), is to the economy. Human, animal, or plant diseases could all have a significant impact. A human quarantine or highly publicized event may affect sales and tourism in the communities resulting in long term economic impacts. Animal or plant diseases nationwide could have an overarching effect on the national economy. More directly, however, Granite County has 140 farms totaling nearly 283,000 acres. In 2002, total cash receipts from agriculture were $9,394,000 with $8,017,000 from livestock sales. At the start of 2004, Granite County had 21,000 head of cattle and 500 sheep for agriculture purposes.[16] This income and livestock could be lost in a severe animal disease outbreak.

Potential Population Impacts

The entire Granite County population of 2,830 plus the tourist population is at risk for contracting disease. The number of fatalities in the county would depend on the mortality rate and the percentage of the population affected. The ability to control the spread of disease will be dependent on the contagiousness of the disease, movement of the population, and the warning time involved.

Impact of Future Development

Future development would not necessarily increase the communicable disease vulnerabilities, but any additional residents would be at risk.

[16] Montana Agricultural Statistics Service. http://www.nass.usda.gov/mt/.

Data Limitations

Disease is a difficult hazard to provide specific vulnerabilities on. For a disease to have a major impact, it first has to enter the community and then spread. That starting point, how the disease progresses, and preventative actions taken will determine the eventual outcome. The data and analysis are limited by these outside factors.

DAM FAILURE

Description

Dams have been placed around Montana for many reasons including recreation, flood control, irrigation, water supply, hydroelectricity, and mining. Dams are built and owned by a variety of entities such as private individuals, businesses, and government. They also come in all shapes and sizes from small earthen dams to large concrete structures. The structural integrity of a dam depends on its design, maintenance, and weather/drainage situation. Problems arise when a dam fails and people and/or property lie in its inundation area. Dams can fail for a variety of reasons including poor maintenance, overwhelming weather and flow conditions, or by an intentional act. Dam failure can be compared to riverine or flash flooding in the area downstream from the dam, and sometimes for long distances from the dam, depending on the amount of water retained and the drainage area. Other dams may be located in areas that result in little if any damages during a failure.

Hazard ratings are given to dams for emergency management planning purposes. These ratings, high, significant, and low, are based on the potential for loss of life and property damage from the failure of the dam, not the condition or probability of the dam failing. Definitions, as accepted by the Interagency Committee on Dam Safety, are as follows:

> *Low Hazard Potential*
> *Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.*
>
> *Significant Hazard Potential*
> *Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.*
>
> *High Hazard Potential*
> *Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.*

Granite County has four high hazard dams and twelve low hazard dams as shown in Table 4.33.

Table 4.33 Dams in Granite County, Montana[17]

Dam Name	River	Year Finished	Hazard	Owner
East Fork Rock Creek	East Fork Rock Creek	1938	High	State of Montana
Flint Creek	Flint Creek	1905	High	Granite County
Fred Burr Lake	Fred Burr Creek	1930	High	Town of Philipsburg
Lower Willow Creek	Lower Willow Creek	1962	High	Lower Willow Creek Drainage District
Albicaulis Lake	Tributary of North Fork Racetrack Creek	1936	Low	Loubren Corporation
Alpine Lake	North Fork Racetrack Creek	1933	Low	Loubren Corporation
Bayer #1	Dirty Dick Creek	1900	Low	William Bayer
Big Racetrack Lake	Racetrack Creek	1973	Low	Glenn Launderville
Caruthers Lake	Tributary of Dempsey Creek	1973	Low	Tamcke Brothers
Douglas Creek	Douglas Creek	1968	Low	Ernest Wight
Fisher Lake	Tributary of Racetrack Creek	1921	Low	Loubren Corporation
Goldberg East	Ditch from North Fork Gold Creek	1956	Low	Bender & Baggett
Goldberg West	Deerlodge Creek	1956	Low	Bender & Baggett
Pozega #1	Tributary of Racetrack Creek	1955	Low	Lemon Ranch
Pozega #2	Tributary of Racetrack Creek	1955	Low	Mt. Haggin
Pozega #3	Tributary of Racetrack Creek	1958	Low	Leo Nicholes

History

On June 29, 1996, a US Forest Service employee observed muddy water flowing from the main embankment of East Fork Dam. DNRC, the Flint Creek Water Users Association, and the Granite County Sheriff were notified and arrangements were made for constant monitoring of the dam. Reservoir releases were increased immediately to reduce pressure against the dam and reduce the potential of a breach, or failure. The area downstream of the dam was evacuated until the reservoir contents were reduced to a safe level. Design investigations began almost immediately and construction of the repairs began in early August.[18] On July 11, 1996, an "incident" was declared by the Governor (Executive Order 16-96) that authorized the use of state resources for the protection of life and property.

The Fred Burr Lake Dam is owned by the Town of Philipsburg and the reservoir serves as the municipal water supply for the town. In 1998, dam repairs totaling $284,384 were made after significant seepage raised safety concerns.[18]

Probability

The probability of dam failure in Granite County is considered moderate. High hazard dams are the most likely to cause damages. The Montana Department of Natural Resources and Conservation keeps

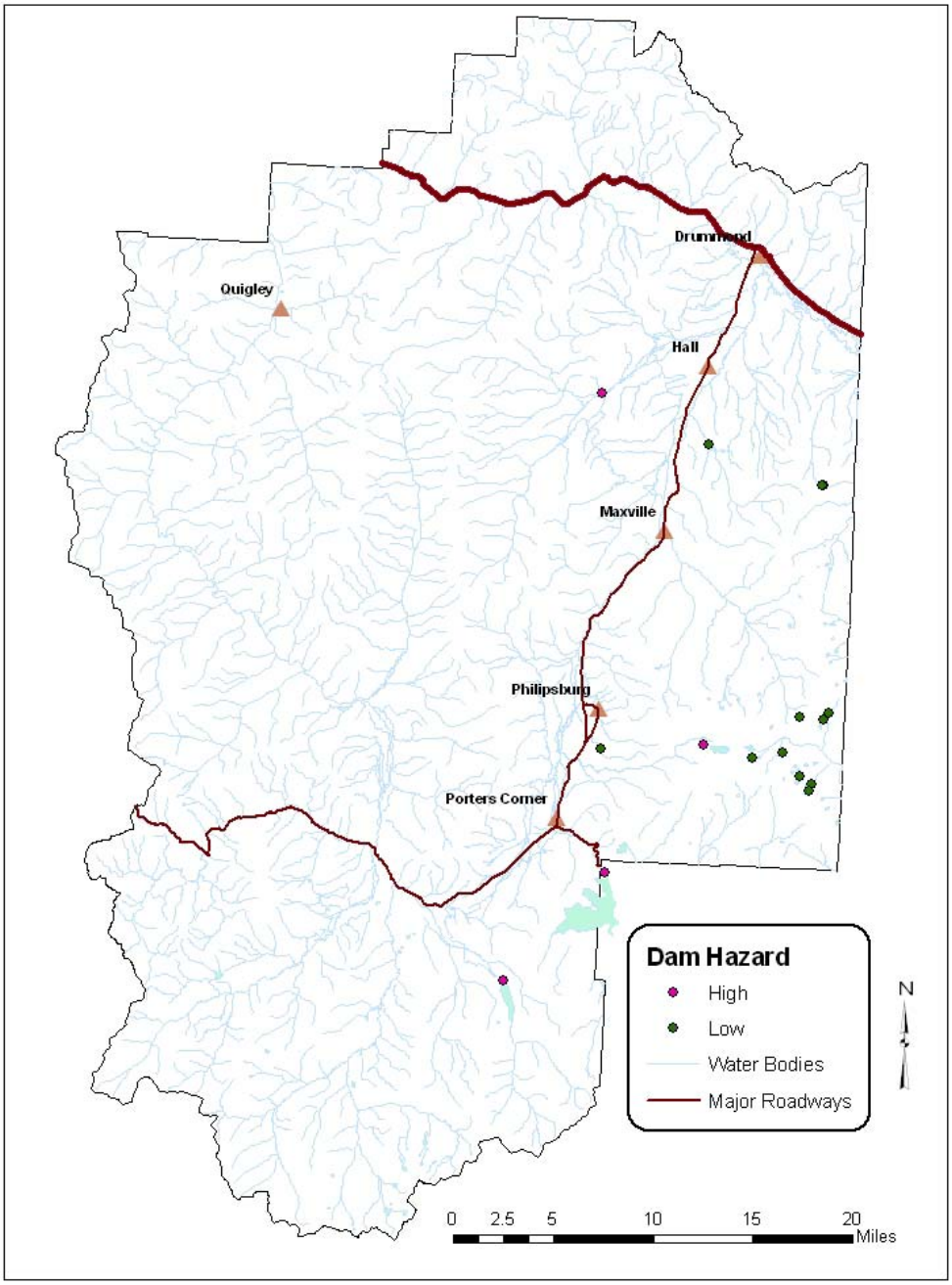
[17] National Inventory of Dams. http://crunch.tec.army.mil/nid/webpages/nid.cfm.
[18] Water Storage in Montana. A Report Submitted to the Fifty-sixth Montana Legislature by Governor Marc Racicot pursuant to Montana Code Annotated. Sec. 85-1-704(1991). January 1999.

an assessment of dams not meeting safety standards. The Lower Willow Creek Dam is listed as a dam that requires further analysis or remediation because the spillway standards have not been met.

Mapping

The locations and hazard assignment of dams in Granite County can be found on Map 4.34.

Map 4.34 Dams in Granite County, Montana



Data Source: US Army Corps of Engineers, National Inventory of Dams

Inundation mapping for the four high hazard dams exist in their Emergency Dam Plans. Copies of these plans are kept by the Granite County Sheriff's Department and other offices in the county.

The East Fork Rock Creek Dam has the capability to "smash bridges and cars" should it fail. The dam inundation area would extend along Rock Creek and would likely affect the East Fork and Bighorn Campgrounds, residences, Quigley, and then Clinton in Missoula County.[19]

The Flint Creek Dam, also known as the Georgetown Lake Dam, would flood along Flint Creek through a narrow canyon to Porter's Corner. The inundation area then expands in the valley and remains west of Highway 1 past Philipsburg, 10.5 miles downstream from the dam. The inundation area continues along Flint Creek, crosses Highway 1 south of Hall, and remains south of Interstate 90 until the confluence with the Clark Fork River. Vulnerabilities in the inundation area include occupied dwellings, Highway 1, Montana Rail Link railway, and Interstate 90. The Emergency Action Plan lists in its contacts 12 residents within 3 miles of the dam and 21 residents 4-10 miles from the dam.[20]

The Fred Burr Lake Dam sits on Fred Burr Creek, a tributary of Flint Creek and the Clark Fork River. The dam is owned by the Town of Philipsburg as a municipal water supply 7.6 miles southeast of Philipsburg. Assets in the inundation area include occupied dwellings, Highway 1, and private, county, and state bridges. The nearest residence is 4.5 miles downstream. Nineteen structures are within the inundation area and 23 others would be evacuated due to isolation with an estimated 67 evacuees. The plan contains an Emergency Evacuation Area Map.[21]

A failure at the Lower Willow Creek Dam would affect Hall within 1.7 hours and Drummond in 6.1 hours. Twenty-two structures along Willow Creek, including the fire hall in Drummond, would be affected. In Hall, twenty structures, including the Post Office and Hall School, would be inundated.[22]

Associated Hazards and Other Factors

Dam failure is most often associated with other hazards. Rarely do dams just crumble and break without some other underlying cause. Heavy rainfall or high water levels from rapid snowmelt are typically a contributing factor in a dam failure. In this scenario, flooding may already be occurring, and a dam break would aggravate the situation. Dams can also fail during a significant earthquake. Dam failure as a terrorist act has also been proposed by many agencies evaluating our homeland security.

Vulnerability

Critical Facilities

Table 4.35 shows the critical facilities that would potentially be affected by dam failures of the various high hazard dams in Granite County.

[19] State of Montana Department of Natural Resources and Conservation. East Fork Rock Creek Dam Emergency Action Plan. Mar 1998.
[20] Granite County. Flint Creek Dam Emergency Action Plan. April 1, 2001.
[21] Town of Philipsburg. Fred Burr Lake Dam Emergency Action Plan. August 6, 2004.
[22] Lower Willow Creek Drainage District. Lower Willow Creek Emergency Action Plan. April 3, 2005.

Table 4.35 Critical Facilities in Dam Inundation Areas

Dam	Critical Facilities Likely Affected
East Fork Rock Creek Dam	▪ Lolo National Forest, Rock Creek Ranger Station
Flint Creek Dam	▪ Flint Creek Hydroelectric Plant ▪ Northwestern Energy Gas Substation, Drummond ▪ Northwestern Energy Electric Substations, Drummond ▪ Montana DOT Weigh Station, Eastbound ▪ Montana DOT Shop
Fred Burr Dam	▪ None
Lower Willow Creek Dam	▪ Hall Elementary School ▪ Hall Post Office ▪ Drummond Fire Station ▪ Northwestern Energy Gas Substation, Drummond ▪ Northwestern Energy Electric Substations, Drummond ▪ Montana DOT Weigh Station, Eastbound ▪ Montana DOT Shop

Potential Losses

For each dam, an estimated number of structures and bridges were calculated to be in the inundation area. These estimations were based on viewing the paper inundation maps from the Emergency Action Plans and selecting structures from the digital structure data that appeared to be in the general vicinity of the inundation area. Therefore, these estimates may have a large margin of error. The monetary exposure was then determined using a value of $78,300 per structure based on US Census data. In most cases, many of the structures would only have moderate, minor, or no damage, and some may not even lie within the inundation area due to the methodology used, so an estimate of 30% is used as the damage factor. Table 4.36 outlines the potential losses from the four high hazard dams in Granite County.

Table 4.36 Potential Losses from Dam Failure in Granite County, Montana

Dam	Estimated Structures in the Inundation Area	Structure Value Exposure	Estimated Potential Losses	Other Estimated Exposures
East Fork Rock Creek Dam	245 structures	$19,183,500	$5,755,050	20 bridges 4 campgrounds 1 trailhead
Flint Creek Dam	177 structures	$13,859,100	$4,157,730	32 bridges
Fred Burr Dam	19 structures	$1,487,700	$446,310	5 bridges 23 additional residences evacuated
Lower Willow Creek Dam	42 structures	$3,288,600	$986,580	15 bridges

Potential Population Impacts

With any flooding or dam failure event, the loss of life is always possible. A dam break can happen rapidly and would most threaten those within close proximity of the dam. Once the break is

recognized, however, those downstream can be warned and evacuated. For each of the high hazard dams, the number of residents in the inundation area can be estimated based on the number of structures at risk. With 2,735 structures in the database analyzed and a population of 2,830, 1.035 people per structure are estimated. Table 4.37 shows the estimated population at risk. The campgrounds were estimated to have a population of 50. The actual risk to the population and casualties will be dependent on the number of residents home and others in the area at the time of the dam break and the associated flooding.

Table 4.37 Estimated Population in the Dam Inundation Areas of Granite County, Montana

Dam	Estimated Structures in the Inundation Area	Estimated Population at Risk in Structures	Other Estimated Populated Exposures	Estimated Population Evacuated
East Fork Rock Creek Dam	245 structures	254 people	4 campgrounds	454 people
Flint Creek Dam	177 structures	183 people		183 people
Fred Burr Dam	19 structures	20 people	23 additional residences evacuated	44 people
Lower Willow Creek Dam	42 structures	43 people		43 people

Impact of Future Development

Currently, much of the development in Granite County is occurring outside the dam inundation areas. Many agricultural and undeveloped lands are in the inundation areas, and therefore, the potential for significant development does exist. Should development occur in those areas, the structures, infrastructure, and population at risk would increase, particularly in the short warning time areas. Currently, subdivision regulations do not specifically consider dam inundation areas but do recognize flood hazard areas.

Data Limitations

Readily available digital data outlining the inundation areas of high hazard dams would allow for a slightly more detailed analysis of potential losses and mapping in this plan. Otherwise, the analysis and mapping of the dam hazard are thoroughly outlined in the individual Emergency Action Plans. All of the dams in Granite County, except the Lower Willow Creek Dam, meet state dam safety standards. Detailed studies on the probability of a dam failure, including the possibility of a seismically induced break, would benefit this overview.

DROUGHT

Description

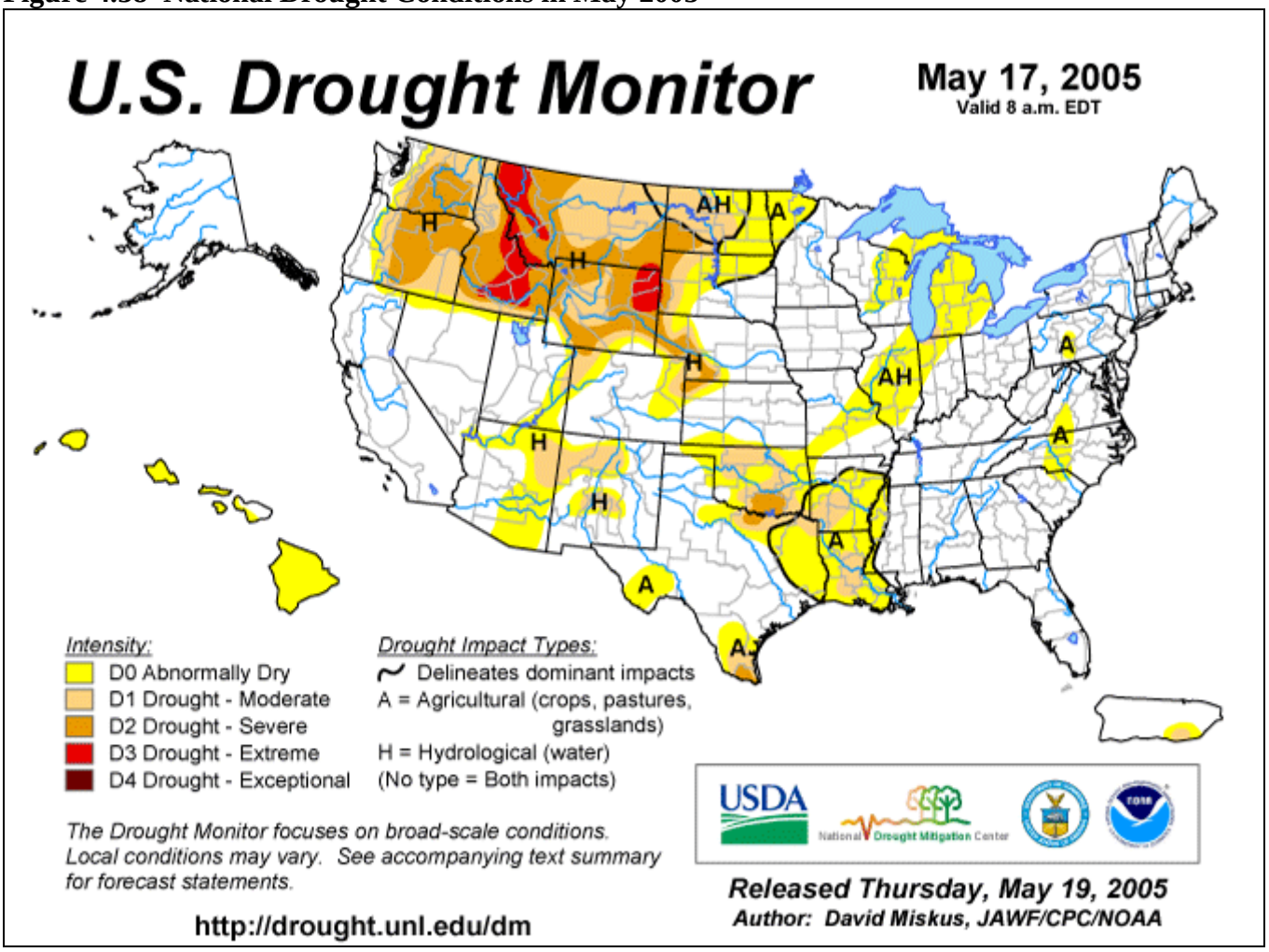
"Drought is an insidious hazard of nature. Although it has scores of definitions, it originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration) in a particular area, a condition often perceived as "normal". It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity."[23]

Droughts can range from minor to severe, short-term to long-term, with a variety of determining factors such as precipitation, soil moisture, and tree moisture. A minor, short-term drought can slip by unnoticed while a long-term severe drought can impact the agricultural economy, natural resources such as fish populations, and even public water supplies. In Montana, drought conditions have also been associated with grasshopper infestations and blight.

Montana is known for its arid climate and Granite County is no exception. The region has been in drought for the past several years based on climate information, drought indices such as the Palmer Index, and drought monitoring at the national level. Figure 4.38 shows the drought status of the United States in May 2005. Note that Granite County is located in the "extreme" to "severe" drought intensity. The State of Montana has a Drought Advisory Committee and a State Drought Plan in place to address this hazard. Historical weather records show that Granite County temperatures can get as high as 104ºF in the summer with extremely low humidities and high winds. Such dry, hot conditions exacerbate drought conditions during periods of low precipitation.

[23] National Drought Mitigation Center. http://www.drought.unl.edu/index.htm.

Figure 4.38 National Drought Conditions in May 2005



History

Drought has a long history in Granite County and all of Montana. Paleoclimate studies show extreme periods of drought hundreds of years ago. The periods of 200-370 A.D., 700-850 A.D., and 1000-1200 A.D. are identified as long-term periods of drought in the Northern Great Plains.[23] In recent times, a more detailed weather monitoring network has developed, and climate records generally date back 100 years in Montana. Based on data from Montana Disaster and Emergency Services, Granite County has been in drought several times over the past decade. Table 4.39 identifies and describes these periods.

Table 4.39 Granite County Drought Periods since 1900[11]

Time Period	Description
1930's	The "Dust Bowl" created erosion problems and dust storms throughout the state.
1960's	Entire state affected, although the impact of this drought was lessened through better conservation practices such as strip cropping.
1970's	By May 1977, over 250,000 acres of Montana farmland was damaged by wind. The State of Montana began taking protective measures due to critically low hydroelectric power supplies.
1985	USDA drought disaster declaration. A typical 2,500 acre farm lost more than $100,000 in equity. The state agriculture industry lost nearly $3 billion in equity.
2000-2005	Statewide drought disaster designations in 2000, 2001, and 2002. In 2003, concerns were raised by the Town of Philipsburg over low public water supplies. In 2004, Granite County, as a "contiguous" county, was given a USDA Secretarial Disaster Designation. Most protective measures were conducted at the individual level.

Probability

The National Oceanic and Atmospheric Administration Paleoclimatology Program has studied drought by analyzing records from tree rings, lake and dune sediments, archaeological remains, historical documents, and other environmental indicators to obtain a broader picture of the frequency of droughts in the United States. According to their research, "…paleoclimatic data suggest that droughts as severe at the 1950's drought have occurred in central North America several times a century over the past 300-400 years, and thus we should expect (and plan for) similar droughts in the future. The paleoclimatic record also indicates that droughts of a much greater duration than any in the 20th century have occurred in parts of North America as recently as 500 years ago."[24] Based on this research, the 1950's drought situation could be expected approximately once every 50 years or a 20% chance every ten years. An extreme drought, worse than the 1930's "Dust Bowl" has an approximate probability of occurring once every 500 years or a 2% chance of occurring each decade.

Mapping

Drought is regional hazard, and therefore, mapping at the county level is not appropriate here. The county is assumed to have the same risk countywide. Mapping of the current drought status is published by the US Drought Monitor weekly and the Montana Drought Advisory Committee monthly from March through October.

[24] National Climatic Data Center, Paleoclimatology Branch. http://www.ngdc.noaa.gov/paleo/paleo.html.

Associated Hazards and Other Factors

Drought is most commonly associated with wildfire in Granite County. Dry conditions contribute to lower moisture content in the trees and plants that provide fuel for wildfires. An initial look at the driest years show that they do not directly coincide with severe wildfire seasons, however, the effects of drought can carry into the long term. One season of severely low precipitation may not be enough for extreme fire behavior, however, followed by several seasons of below normal precipitation, the conditions can contribute to an increased probability for significant wildfires. Drought often kills trees and plants that then become very dry fuels for wildfires years later. Short-term drought conditions can prime grasses on non-irrigated lands for grass fires and long-term drought conditions can additionally impact the heavier timber fuels for forest fires.

Counter intuitively, in mountainous areas, such as Granite County, drought can quickly be followed by flash flooding. Dry soils are not as permeable to water, and therefore, heavy rains run off faster than on moist soils and can more easily lead to flash flooding.

Blight and grasshopper infestations have a greater probability of occurring in drought conditions. Besides the hydrologic and agricultural impacts, drought can also lead to severe duststorms and soil erosion affecting the population and non-agriculture economies. Additional concerns include the water temperatures for fish populations, hydroelectric power supplies, and public water sources.

Vulnerability

Critical Facilities

Generally, critical facilities are not affected directly by drought. Infrastructure relying on the water supply is the primary exception. If the water supply for public drinking water and sewer systems was threatened, those losses could total millions of dollars should equipment be damaged or outside water need to be shipped into the county. The probability of a drought of that significance is considered low.

Potential Losses

The most probable losses from drought are to the economy. Drought significantly impacts the agricultural economy and can additionally impact tourism. Crops are directly affected by drought and the over $1 million economy in Granite County could potentially be lost if the drought worsens.

Crops aren't the only aspect of agriculture affected by drought. Livestock can also be impacted. The pasture and food supply available to the animals is directly related to drought conditions. With over $8,000,000 in livestock sales in 2002, this larger agricultural economy is additionally threatened by drought.

Natural resources, and therefore tourism, are influenced by drought. As river and stream levels drop, fish populations and other natural resources are impacted. With fishing and river recreational activities an important part of the tourism industry in Granite County, those aspects of the economy can be threatened during extended periods of drought.

Potential Population Impacts

Since drought evolves slowly over time, the population has ample time to prepare for its effects and is warned accordingly. The greatest direct threat to the population from drought is through the drinking water supply. Should a drought affect the water available for public water systems or individual wells, the availability of clean drinking water could be compromised. This situation would require emergency actions and could possibly overwhelm the local government and financial resources.

Impact of Future Development

Future development's greatest impact on the drought hazard would be through possibly limiting ground water resources. Fortunately, public systems, individual wells, and septic systems are carefully monitored and permitted by Montana Department of Environmental Quality. Therefore, the impact of future development with respect to drought is considered low.

Data Limitations

The greatest data limitation with drought is the inability to pinpoint the start and end of drought periods and the associated correlation with economic losses. An online database of historical USDA drought declarations and the associated losses would prove beneficial in documenting the effects of drought and directing mitigation activities.

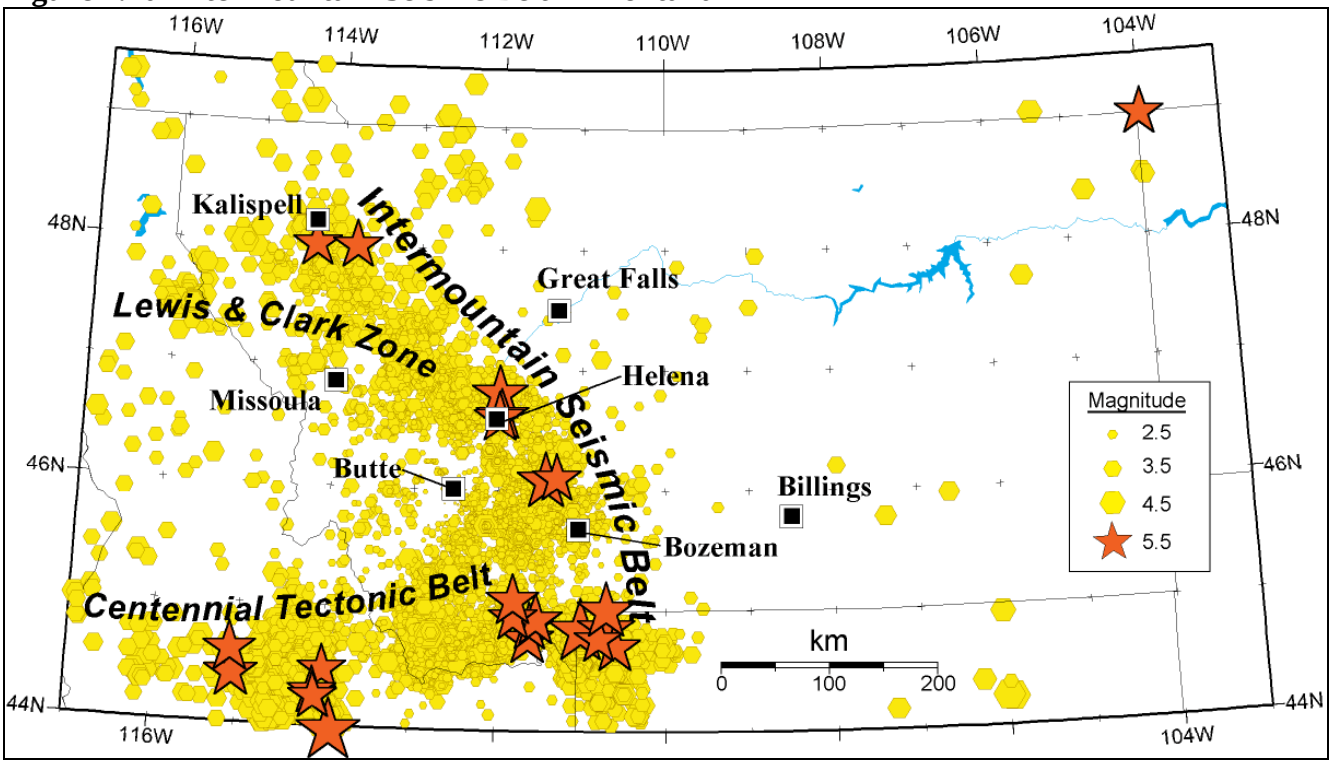
EARTHQUAKE

Description

One of the most frightening and destructive phenomena of nature is a severe earthquake and its terrible aftereffects. An earthquake is a sudden movement of the Earth, caused by the abrupt release of strain that has accumulated over a long time. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface slowly move over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free. If the earthquake occurs in a populated area, it may cause many deaths and injuries and extensive property damage.[25]

Montana is the eighth ranked state in the United States for earthquake occurrences and has many faults, primarily in the mountainous parts of the state. The Intermountain Seismic Belt, shown in Figure 4.40, demonstrates the active seismic areas of the state. Granite County lies just to the west of the most active areas and has been in close proximity to many significant earthquakes. Earthquakes can damage property and infrastructure very rapidly and significantly with little warning, severely impacting those close to the epicenter. Often, strong earthquakes can felt for hundreds of miles.

Figure 4.40 Intermountain Seismic Belt in Montana[26]



[25] US Geological Survey. http://pubs.usgs.gov/gip/earthq1/intro.html.
[26] Montana Bureau of Mines and Geology, Earthquake Studies Office. http://mbmgquake.mtech.edu/interm_s_b.html.

History

Since 1900, eight earthquakes of magnitude 5.5 or greater have occurred within 100 miles of Granite County. Table 4.41 shows the list of these earthquakes.

Table 4.41 Earthquakes Magnitude 5.5 or greater within 100 miles of Granite County[27]

Date	Approximate Location	Magnitude
6/28/1925	Clarkston	6.6
2/16/1929	Lombard	5.6
10/12/1935	Helena	5.9
10/19/1935	Helena	6.3
10/31/1935	Helena	6.0
11/23/1947	Virginia City	6.1
3/31/1952	Swan Lake	5.5
7/25/2005	Dillon	5.6

The Hebgen Lake earthquake on August 18, 1959 is the most significant earthquake to have occurred in Montana over the past 100 years. The earthquake, located just over 100 miles from Granite County, was felt in the county but no damages were reported there. The magnitude 7.5 earthquake occurred to the southeast of Granite County near Yellowstone National Park. This surface rupturing earthquake changed the geology of the Hebgen Lake area and triggered a major landslide (80 million tons of rock). The result was the creation of a new lake, Earthquake Lake, on the Madison River and State Highway 287 was buried. Twenty-eight people were killed and roadway and timber damages totaled over $11 million. The quake was felt in 8 states and 3 Canadian provinces.[28]

Although greater than 100 miles away, the magnitude 7.3 Borah Peak earthquake near Challis, ID on October 28, 1983 was felt in Granite County. The recent Dillon earthquake was also felt throughout the county.

Probability

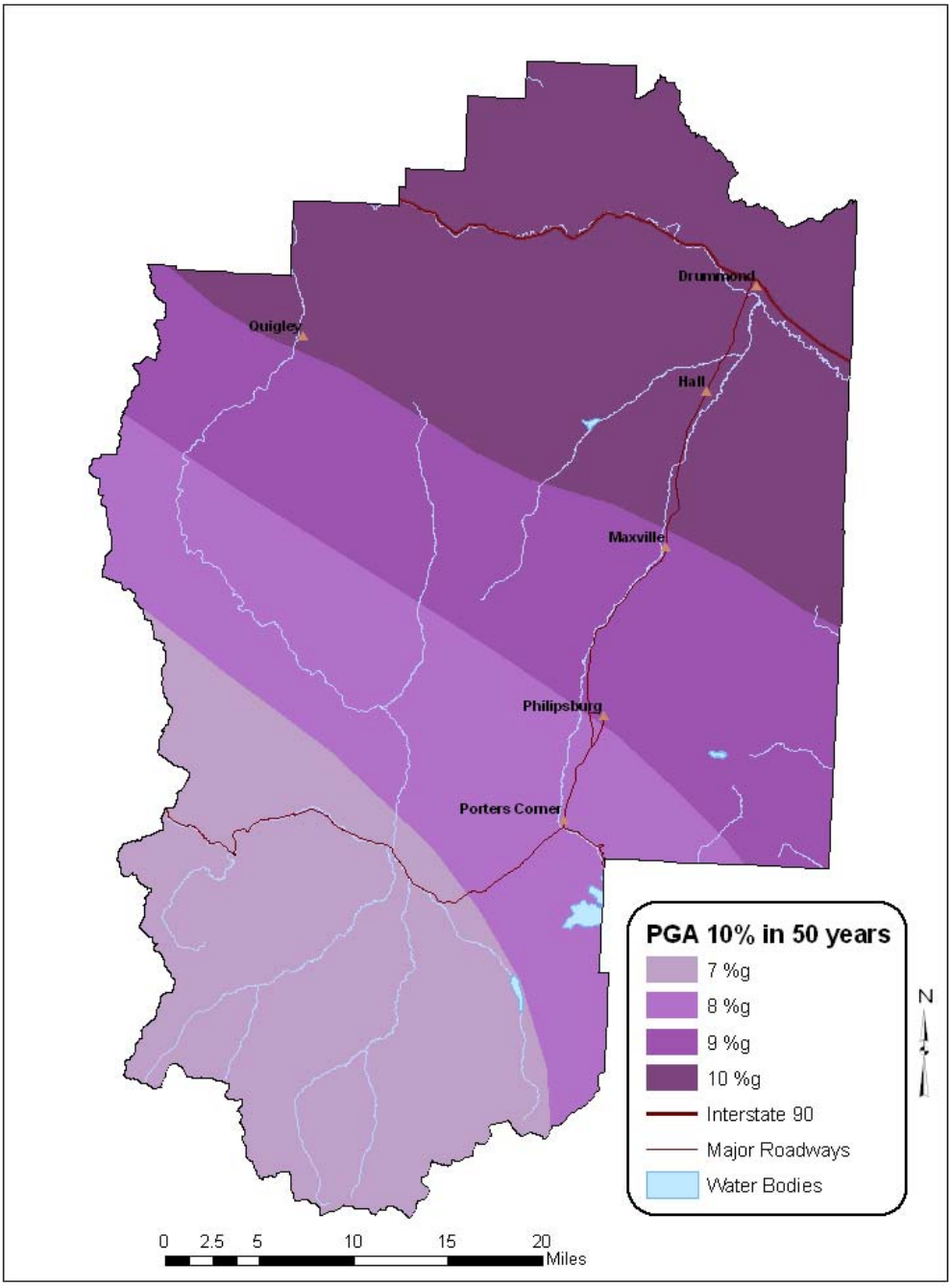
Earthquakes, when large and damaging, are infrequent events. Granite County regularly experiences small earthquakes, but they are undetectable except by instrumentation. The mapping section that follows outlines some of the probabilities used in earthquake modeling as it varies throughout the county. Recurrence intervals for Western Montana are currently being refined. Based on one study, Northern Granite County lies within the Northern Intermountain Seismic Belt source zone. This region is estimated to have a recurrence rate of 3.84 years for a magnitude 5 or greater earthquake, 22.6 years for a magnitude 6 or greater earthquake, and 133 years for a magnitude 7 or greater earthquake. Southern Granite County lies within the Northern Rocky Mountain seismic source zone. This region is estimated to have a recurrence rate of 36.6 years for a magnitude 5 or greater earthquake, 420 years for a magnitude 6 or greater earthquake, and 4,821 years for a magnitude 7 or greater earthquake.[13]

[27] Stickney, Michael et al. Quaternary Faults and Seismicity in Western Montana. Montana Bureau of Mines and Geology Special Publication 114. 2000.
[28] US Geological Survey. http://neic.usgs.gov/neis/states/montana/montana_history.html.

Mapping

Research through the US Geological Survey's National Seismic Hazard Mapping Project has resulted in peak ground acceleration maps related to the probability of seismic shaking. The map for Granite County, Map 4.42, shows the strength of seismic shaking that has a 10% probability of being exceeded in a 50 year period. The strength of the shaking is measured as a percent of the acceleration of gravity (%g). As Map 4.42 shows, the earthquake hazard in Granite County is greater to the northeast.

Map 4.42 Peak Ground Acceleration (%g) with a 10% Probability of Exceedance in 50 Years



Data Source: US Geological Survey and Montana Bureau of Mines and Geology

Granite County does not have any known active faults. History has shown that significant earthquakes (up to magnitude 6.5) may occur anywhere throughout the Intermountain Seismic Belt, even in areas where young faults are not recognized. Examples of damaging earthquakes for which no known surface fault was recognized include the 1925 Clarkston earthquake (magnitude 6.6) and the 1935 Helena earthquakes (magnitude 6.3-5.9).

Associated Hazards and Other Factors

The seismic action of earthquakes often triggers other events. Landslides are quite common in Montana with large earthquakes. During the winter, avalanches can also be triggered. Dam breaks and landslides on waterways may cause flooding. The rupture of gas lines can result in large scale urban fires, particularly if power outages or broken water mains disrupt water supplies. Any number of additional incidents may occur due to the failure of infrastructure such as hazardous material spills, communications failure, and large scale transportation accidents. All of these associated factors contribute to the severity of the earthquake event.

Vulnerability

Critical Facilities

Most of the county has comparable seismic risk based on the probable peak ground accelerations. Based on this, all of the critical facilities and vulnerable populations are considered to have approximately the same probability for seismic shaking. Table 4.43 lists the number of critical facilities for each PGA.

Table 4.43 Critical Facilities by PGA in Granite County, Montana

PGA	Number of Facilities
10%g	35 Critical Facilities and Vulnerable Populations
9%g	27 Critical Facilities and Vulnerable Populations
8%g	15 Critical Facilities
7%g	1 Critical Facility

A detailed study of each of the critical facilities would need to be conducted to determine the specific vulnerability to that structure and the likelihood and magnitude of damages. The HAZUS loss estimation model results presented in the Potential Losses section does specify the functionality of certain critical facilities contained in the model database.

Potential Losses

Using the Peak Ground Acceleration (PGA) mapping, the number of structures can be estimated for the different values of PGA. Table 4.44 lists these exposures.

Table 4.44 Structure Exposure by PGA Probability in Granite County, Montana

PGA	Number of Non-Commercial Structures	Estimated Value of Non-Commercial Structures	Number of Commercial Structures
10%g	778 structures	$60,917,400	74 businesses
9%g	767 structures	$60,056,100	74 businesses
8%g	871 structures	$68,199,300	22 businesses
7%g	144 structures	$11,275,200	5 businesses

Earthquake damages can be difficult to predict and assess without detailed structure information or a damage model. Fortunately, the Federal Emergency Management Agency has developed loss estimate software for earthquakes (HAZUS). This model uses national databases to estimate the earthquake losses from a particular event at the census block, tract, or county level. Although the default data provided with the model is far from accurate, the model provides a general estimate of what earthquake losses may occur and the magnitude of such. Should Granite County decide to import more accurate data, the results will be significantly improved. The results from a default, level 1 run through the model follows. HAZUS has an inventory of 1,897 structures and is known to overestimate the structure replacement values for this area. Despite this, two simulations were run through the model for 100-year and 500-year events.

<u>100-year Earthquake in Granite County (Magnitude 5.0)</u>

- Structure Damages:
  - Complete: 0 structures
  - Extensive: 3 structures
  - Moderate: 51 structures
  - Slight: 141 structures
- Capital Stock Losses (structural, non-structural, contents, and inventory): $950,000
- Income Losses (relocation, capital related, wages, and rental income): $80,000
- Hospital Functionality: 95%
- Bridges: Minimal damages totaling roughly $50,000
- Airport: Damages totaling roughly $400,000
- Utilities: Damages to water and natural gas systems totaling roughly $480,000
- Casualties: 0

<u>500-year Earthquake in Granite County (Magnitude 7.0)</u>

- Structure Damages:
  - Complete: 2 structures
  - Extensive: 34 structures
  - Moderate: 189 structures
  - Slight: 363 structures
- Capital Stock Losses (structural, non-structural, contents, and inventory): $5,250,000
- Income Losses (relocation, capital related, wages, and rental income): $490,000
- Hospital Functionality: 67%
- Bridges: Damages totaling roughly $1,020,000
- Airport: Damages totaling roughly $1,100,000
- Utilities: Damages to water and natural gas systems totaling roughly $2,920,000
- Casualties: 1

These results from HAZUS could potentially be more accurate and informative if better data was developed and used in the analysis. Many structures, including critical facilities, within Granite County have not been seismically assessed. As the 2000 US Census data indicates, over 63% of residences were constructed prior to 1980 and over 24% of residences were constructed prior to 1940. Many of the existing homes, businesses, and critical facilities may not be structured to withstand seismic shaking.

Potential Population Impacts

The population would have little or mostly likely no warning prior to an earthquake. Most casualties in a large earthquake in Granite County would be anticipated with building collapse, roadway failures, falling objects, and landslides. As the HAZUS runs show, only a few casualties could be expected in a 500-year period. Table 4.45 list the population exposure based on the PGA Probability estimated for the structures in the county.

Table 4.45 Population Exposure by PGA in Granite County, Montana

PGA	Number of Structures	Estimated Population at Risk
10%g	852 structures	882 people
9%g	841 structures	870 people
8%g	893 structures	924 people
7%g	149 structures	154 people

Impact of Future Development

All future development in Granite County is at risk for earthquake damages. Fortunately, construction standards for seismic stability have improved over the past 100 years. Granite County does not have a local building code. Except for the energy, plumbing, and electrical codes, the State Building Code is not applicable for residential structures less than five dwelling units. Without any known faults in the county, development occurs without regard to specific earthquake hazard areas.

Data Limitations

Since earthquakes are a relatively rare event, perhaps the greatest challenge is understanding the true probability and damages possible. More research is needed in identifying fault areas and developing digital data for use in the HAZUS modules. Improving the modeling and assessing individual facilities will allow for a more accurate vulnerability assessment, particularly in the downtown Philipsburg area where many historic, unreinforced masonry buildings exist.

FLOODING

Description

Flooding is the inundation of a normally dry area with water. Riverine flooding occurs on rivers, creeks, and streams as water levels rise be it from excessive precipitation, rapid snowmelt, dam failure, or ice jams. Unlike riverine flooding, flash flooding can happen anywhere. As the name implies, flash flooding happens quickly after intense rains, dam or ice jam breaks, or rapid runoff in mountainous or recently burned areas. Urban flooding is the result of development and the ground's decreased ability to absorb the rainfall. Flooding from groundwater does not typically result in floodwaters at the surface, but occasionally basements and crawlspaces can be flooded by excessive groundwater.

Flooding is different from most other hazards in that riverine flooding problems are managed through a national insurance system called the National Flood Insurance Program (NFIP) under the Federal Emergency Management Agency (FEMA). FEMA conducts a Flood Insurance Study (FIS) of a region to identify the community's risk levels. The FIS includes statistical data for river flow, rainfall, topographic surveys, as well as hydrologic and hydraulic analyses. After examining the FIS data, FEMA creates Flood Insurance Rate Maps (FIRMs) delineating the different areas of flood risk. Land areas that are at high risk for flooding are called Special Flood Hazard Areas (SFHAs), or floodplains.[29] These maps are certainly not all inclusive and other flood prone areas may exist. Montana is currently undergoing a map modernization process. The FIS and FIRM maps for Granite County, Philipsburg, and Drummond were last updated in 1982. The areas considered in the Flood Insurance Study include Clark Fork, Edwards Gulch, Flint Creek, Camp Creek, Frost Creek, Rock Creek, Boulder Creek, Upper Willow Creek, Ranch Creek, and Douglas Creek.[30] The Clark Fork River is the only area of Granite County that has digital floodplain mapping as shown in Map 4.46. The other areas have only paper maps.

Flooding in Granite County normally occurs during periods of excessive rainfall or snowmelt. The mountainous terrain in Granite County is a contributing factor in flash flood and rapid snowmelt problems. The FIS notes that Granite County has three primary valleys: Clark Fork, Flint Creek, and Rock Creek. Specifically in Philipsburg, "The portion of Camp Creek passing through the central business district of Philipsburg has been diverted into an underground conduit. Most of the stream channel through this section has been filled in and built upon. Broadway Street and many businesses now occupy the area of the original channel. Floodwater exceeding storm-drain capacities must flow down Broadway Street for most of this reach." The FIS notes that the 21-inch storm drain has less than a 10-year flood capacity. Also, "Minor flooding from Frost Creek has been reported in Philipsburg. The Sansome Street culvert on Frost Creek has a capacity to carry flows up to, and including, a 10-year event. Floodflows greater than a 10-year event will cause sheet flooding in the adjacent areas."[30]

Drummond is prone to riverine flooding from the Clark Fork River. According to the FIS, Interstate 90 and railroad beds act as levees along the Clark Fork and in some cases restrict flow and elevate the 100- and 500- year flood elevations. The limited capacity of the culvert under Highway 10A causes ponding and flooding in the area. At the Clark Fork River at Drummond, the Action Stage is considered 8.0 feet, Flood Stage is 8.5 feet, Moderate Flood Stage is 10.5 feet, and Major Flood Stage

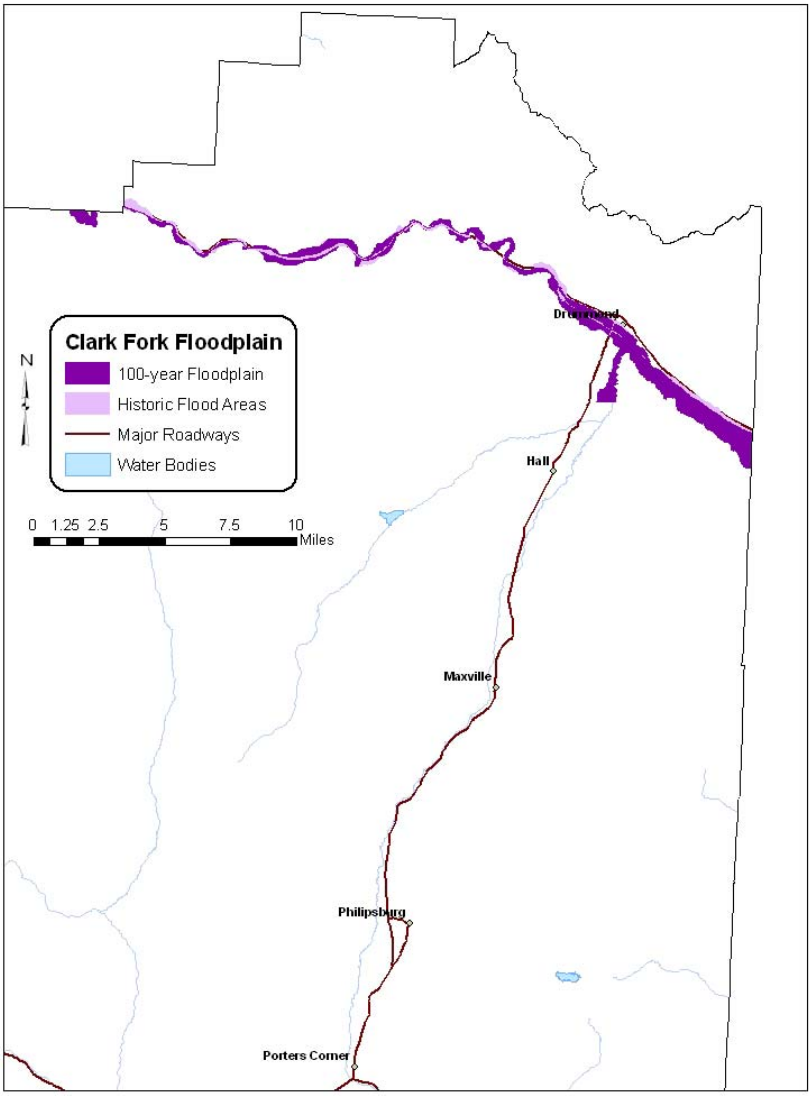
[29] Federal Emergency Management Agency. National Flood Insurance Program, www.floodsmart.gov.
[30] Federal Emergency Management Agency. Flood Insurance Study – Drummond – Philipsburg – Granite County. January 5, 1982.

is 12.0 feet. At 8.5 feet, flooding affects areas adjacent to the river channel. At 10.5 feet, flooding is likely in low lying areas adjacent to the river channel, including the City Park and Rodeo Grounds. At 12.0 feet, homes and roads in the southern section of Drummond are threatened.[31]

A river gauge is also kept on Rock Creek near Clinton which lies along the extreme northwest border of Granite County. For this location, the Action Stage is 7.5 feet, Flood Stage is 8.0 feet, Moderate Flood Stage is 8.5 feet, and Major Flood Stage is 9.5 feet. At 8.0 feet, homes upstream from Clinton between mile markers 10 and 15 are affected. Road washouts are also possible in the upper reaches of the creek.[31]

The 100-year floodplain has a 1% chance of being exceeded in any given year. Development in the 100-year floodplain must meet floodplain construction requirements adopted by Granite County, Drummond, or Philipsburg, and borrowers must purchase flood insurance.

Map 4.46 Clark Fork River Floodplain in Granite County, Montana



Data Source: Montana State Library

[31] National Weather Service, Advanced Hydrologic Prediction Service. www.weather.gov.

History

Granite County has a long history of flooding. The first major documented flood occurred in June 1908 with the most recent in 1997. The historical record has been complied from the Granite County Flood Insurance Study[30] and newspaper accounts.

June 1, 1908 – The Clark Fork River in Drummond peaked at a reported stage of 15.5 feet. With a flood stage of 8.5 feet, this flood was considered a major flood.

1927 - A 50-year event occurred on Rock Creek near Clinton.

March 28, 1943 – A 100-year flood event at Maxville primarily flooded agricultural lands.

June 1, 1972 – A 10-year event occurred on Rock Creek near Clinton (8.52 feet, 6,500 cfs).

June 20, 1974 – Heavy rains and snowmelt from Edwards Gulch near Drummond created sheet flooding through town. Several railroad bridges were lost. This flooding incident was estimated as a 500-year event.

June 20, 1975 – A 10-year event occurred on Rock Creek near Clinton (7.49 feet, 5,520 cfs) and on the Clark Fork River in Drummond (10.6 feet, 7,967 cfs). A federal disaster for flooding was declared throughout Montana.

May 23, 1981 – The Clark Fork River in Drummond reached a stage of 12.44 feet (15,800 cfs). Rock Creek near Clinton reached a stage of 7.53 feet (5,140 cfs).

February 24, 1986 – Flint Creek flooded from heavy snow melt. Hall was the hardest area hit. Highway 10A was shut down and wells, septic systems, and basements were flooded. By late afternoon, Drummond began flooding.[32] Montana was declared a federal disaster area.

February 9, 1996 – The Clark Fork River in Drummond reached a stage of 10.03 feet (9,800 cfs).

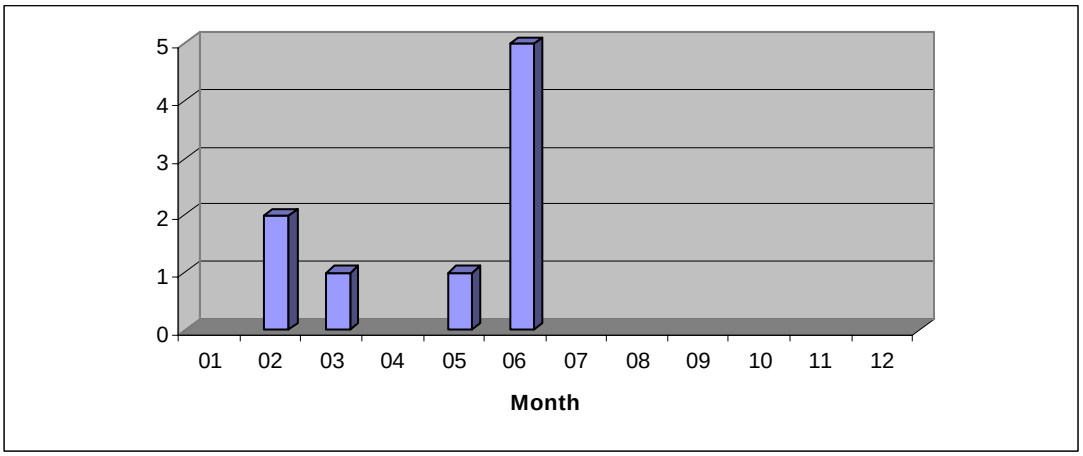
June 9, 1997 – Rock Creek near Clinton reached a stage of 8.1 feet.

Probability

Flooding probabilities are shown through the mapping of the floodplain. The 100-year floodplain has a 1% probability of being exceeded in any given year. Flooding has been noted 10 times since 1908 in Granite County. Based on the historical record over the past 97 years, a damaging flood occurs on average once every 10 years. Recent drought years may have taken an emphasis off flooding concerns, but the probability remains that some degree of flooding can be expected once every decade. Figure 4.47 shows the months when flood events have occurred.

[32] Montana Standard. February 25, 1986.

Figure 4.47 Granite County Flood Events By Month



Probabilities are often measured in exceedance probabilities using discharges (in cubic feet per second) at various locations. Table 4.48 shows the discharges for the stream gauges in and around Granite County.

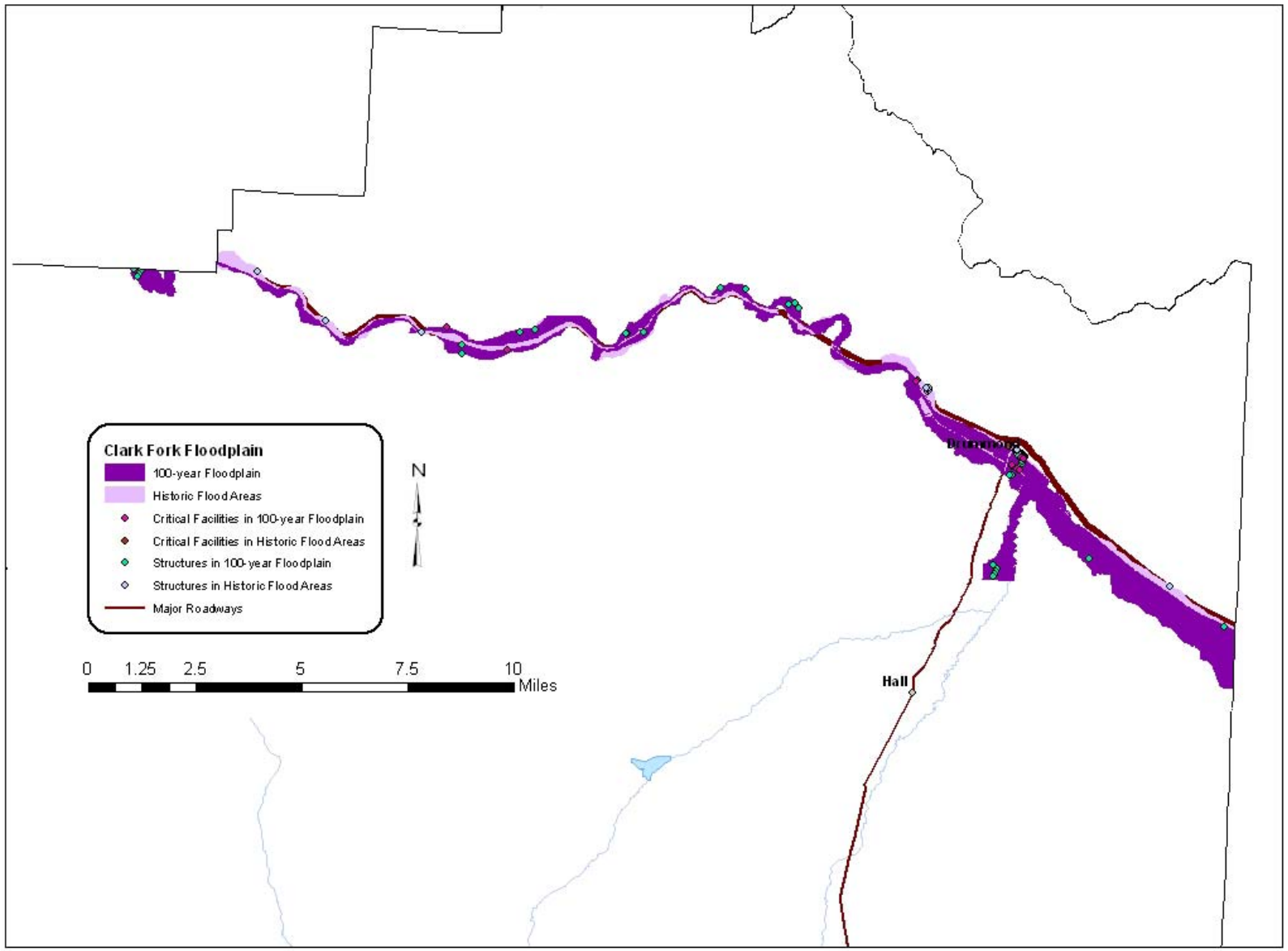
Table 4.48 Peak Discharges and Exceedance Probabilities for Streams in Granite County

Location	Probability of Exceedance			
	1% 100-year event	2% 50-year event	4% 25-year event	10% 10-year event
Boulder Creek at Maxville	1,360 cfs	1,150 cfs	953 cfs	726 cfs
Clark Fork at Drummond	16,200 cfs	13,900 cfs	11,700 cfs	8,850 cfs
Clark Fork Tributary near Drummond	361 cfs	287 cfs	221 cfs	147 cfs
Edwards Gulch at Drummond	443 cfs	311 cfs	209 cfs	113 cfs
Flint Creek at Maxville	1,450 cfs	1,270 cfs	1,090 cfs	862 cfs
Middle Fork Rock Creek near Philipsburg	1,920 cfs	1,790 cfs	1,640 cfs	1,430 cfs
Morris Creek near Drummond	45 cfs	37 cfs	30 cfs	21 cfs

Mapping

In addition to the floodplain mapping shown in Map 4.46, paper maps exist showing the 100-year floodplain in other parts of the county. The digital mapping can be used to show the relationship of critical facilities and structures to the floodplain. Map 4.49 and 4.50 show the critical facilities (shades of red) and structures (shades of blue) in the 100-year Clark Fork floodplain and historic flood areas.

Map 4.49 Granite County Critical Facilities and Structures in the Clark Fork River 100-Year Floodplain and Historic Flood Areas



Data Source: Montana State Library
MaPS, Inc. under contract by Granite County

Map 4.50 Drummond Critical Facilities and Structures in the Clark Fork River 100-Year Floodplain and Historic Flood Areas

Data Source: Montana State Library
MaPS, Inc. under contract by Granite County

Associated Hazards and Other Factors

Excessive rainfall and heavy snows associated with flooding, both riverine and flash, can be related to other hazards. Landslides and mudslides are often attributed to saturated soils and flooding. Flood conditions in and around dams can also be a factor in causing dam failures. During the summer, severe thunderstorms can bring heavy rain, especially if they are slow moving, along with the wind, hail, and tornadoes. Often the runoff causes sediment problems in addition to the flooding. These additional hazards can be factors during flood events. One of the factors mitigating flooding is a levee just upstream of Drummond put in place by the US Army Corps of Engineers.

Vulnerability

Critical Facilities

An analysis of the floodplain shows several critical facilities are in the 100-year floodplain. A GIS analysis using the Clark Fork floodplain data and the critical facilities database identifies the facilities estimated in the 100-year floodplain or historic flood areas. A significant limitation with this approach is that the datasets are inexact and the results should only be used for planning purposes, not actual flood zone determinations. This approach essentially identifies the critical facilities at greatest risk from flooding.

Within the estimated 100-year Floodplain:

- Montana Department of Transportation Weigh Station, Drummond
- Montana Department of Transportation Rest Area, Drummond (valued at $500,000)
- Montana Department of Transportation Loader Shed, Clinton
- Cenex Bulk Plant, Drummond
- Northwestern Energy Electric Substation, Drummond
- Northwestern Energy Natural Gas Substation, South Main Street, Drummond
- Drummond Water Tower/Well House
- Qwest Telephone Substation

Within the Historical Flood Areas:

- Drummond Sewage Lift Station

Ultimately, these critical facilities can be expected to lose their functionality and sustain damages during a major flood. Note that none of the vulnerable populations were estimated in the Clark Fork floodplain.

Since the 100-year floodplain maps are not available in digital format, a buffer of 1,000 feet was created around the larger creeks and streams and a buffer of 100 feet was created around the smaller creeks and streams. Although the actual floodplain widens and constricts depending on the topography, this methodology produces a preliminary estimate of critical facilities that may be at risk for flooding, in addition to those in the Clark Fork floodplain. Within the 1,000 feet buffer of the larger creeks and streams is the Flint Creek Hydroelectric Plant. Additionally, within 100 feet of the smaller creeks and streams is the Drummond Refuse Site.

The vulnerabilities to flash flooding are harder to quantify without specific hazard data. In Montana, however, flash flooding has been known to be most problematic to public infrastructure such as roads.

Flash flood events can wash out roadways in Granite County. Specific critical facilities have not been identified as more susceptible to flash flooding but those structures near creeks and streams and in gulches are most vulnerable.

Potential Losses

Using the same methodology as was used for the critical facility analysis, structure locations were compared to the location of the 100-year Clark Fork floodplain and buffer zones around the creeks and streams. Along the Clark Fork River, 32 structures (2 businesses, 23 residences, 6 mobile homes, and 1 shed) are estimated within the 100-year floodplain and 46 additional structures (18 businesses, 12 residences, 6 mobile homes, 10 duplex housing units) are within historic flood areas. These figures lead to the following loss estimates for planning purposes:

- 78 structures are estimated in or near the 100-year Clark Fork River flood inundation area with a total estimated structure value exposure of $4,453,800 (78 structures x $57,100 value/structure in Drummond).
- In most cases, many of the structures would only have moderate, minor, or no damage, and some may not even lie within the floodplain due to the methodology used, so an estimate of 20% is used as the damage factor.
- $4,453,800 total estimated structure value x 20% damage factor = $890,760 estimated 100-year structure losses within Granite County along the Clark Fork River.

Along the other creeks and streams in Granite County, 564 structures (11 businesses, 234 seasonal dwellings/cabins, 5 camps, 13 general purpose buildings, 251 residences, and 50 mobile homes) are estimated within 1,000 feet of a larger creek or stream and 112 additional structures (8 apartment units, 3 businesses, 34 seasonal dwellings/cabins, 5 general purpose buildings, 49 residences, and 13 mobile homes) are within 100 feet of a smaller creek or stream. These figures lead to the following loss estimates for planning purposes:

- 676 structures are estimated in or near the creeks and streams of Granite County (except the Clark Fork River) with a total estimated structure value exposure of $52,930,800 (676 structures x $78,300 value/structure in Granite County).
- In most cases, many of the structures would only have moderate, minor, or no damage, and some may not even lie within the floodplain due to the methodology used, so an estimate of 20% is used as the damage factor.
- $52,930,800 total estimated structure value x 20% damage factor = $10,586,160 estimated 100-year structure losses from creeks and streams (except the Clark Fork River) in Granite County.

As of December 31, 2004, Granite County had 10 flood insurance policies for a total of $1,097,900 in insurance coverage, Drummond had 2 flood insurance policies for a total of $144,000 in insurance coverage, and Philipsburg had 3 flood insurance policies for a total of $115,800 in insurance coverage leaving much of a flood vulnerable county without any financial coverage for flood damages. According to the State Floodplain Manager, Granite County does not have any repetitive loss flood insurance properties. From January 1, 1978 through December 31, 2004, the National Flood Insurance Program has paid $36,231.26 in flood insurance claims.

Potential Population Impacts

Due to the terrain and hazard areas in Granite County, the population is considered to be at moderate risk for riverine and flash flooding. Some warning does exist, particularly with riverine flooding, but

rapidly occurring events may leave the population unprepared and in a dangerous situation. The impacts from flash flooding could be even greater in areas downstream of wildfire burn areas. Flash flooding often occurs without warning. The population estimated in the 100-year floodplain is 777 people (754 structures x 1.03 people/structure). The population in flash flood areas is unknown as flash flood can occur almost anywhere.

Impact of Future Development

The Town of Philipsburg, Town of Drummond, and the rest of Granite County are mapped and participate in the National Flood Insurance Program. As participants in this program, specific development considerations must be made and a permit issued before development can occur in the 100-year floodplain. Drainage systems in new subdivisions must be designed by a licensed engineer and certified to accommodate a 25-year storm event. Other than those specific requirements, development can occur in and around the floodplain.

Data Limitations

The greatest limitation when analyzing the flood risk in Granite County is a lack of digital floodplain mapping and the mapping that does exist is old and outdated. These data limitations prohibit a detailed study of the potential losses from any given flood. Historical records also often lack definitive figures on the damages to private property.

The HAZUS-MH program is limited in its accuracy for flood losses due to the limitations in the default data, but more importantly because of the its incompatibility with most common versions of software and operating systems. Should these limitations be overcome, a more accurate estimate of flood losses could be determined using HAZUS-MH.

HAZARDOUS MATERIALS RELEASE

Description

A hazardous material release is the contamination of the environment (i.e. air, water, soil) by any material that because of its quantity, concentration, or physical or chemical characteristics threatens human health, the environment, or property. An accidental or intentional release of materials could produce a health hazard to those in the immediate area, downwind, and/or downstream. A hazardous material release can come from a fixed facility or via its transportation through the area.

The most likely locations for a transportation-related hazardous materials release is on Interstate 90 or the active railways. Interstate 90 crosses northern Granite County in an east-west direction through the Town of Drummond. This Interstate is widely used by vehicles transporting hazardous materials. The railroad generally parallels Interstate 90 and the Clark Fork River. The railroad is owned and operated by Montana Rail Link. If a transportation-related release occurred near populated areas or water supplies, serious human impacts could result.

A major fuel pipeline, the Yellowstone Pipeline, runs through northern Granite County, near Interstate 90 and just south of Drummond. This pipeline transports refined petroleum products between Billings, MT and Spokane, WA. Should an explosion or leak occur on this pipeline, a large hazardous material release of the fuel and/or fumes could result and threaten the population and property.

History

Historically, incidents have been small enough to prevent a large evacuation, however, hazardous materials incidents do occur in Granite County. The incidents logged with the National Response Center can be found in Table 4.51.

Table 4.51 Hazardous Materials Incidents in Granite County[33]

Date	Location	Substance	Quantity	Responsible Party
05/27/1991	Railroad, Mile 94.3, Clinton, 15 car derailment	N/A	N/A	Montana Rail Link
02/05/1993	Drummond, Cenex Station	Diesel	15 gallons	Cenex
03/09/1993	Drummond, Cenex Station	Gasoline	600 gallons	Cenex
06/10/1993	Hall, Cheryl Crossing	Hydraulic Oil	50 gallons	Peterson Trucking
09/25/1993	I-90, Mile 139	Diesel	20 gallons	Concord Transportation
01/02/1994	I-90 W, Mile 143	Diesel	80 gallons	Kline Trucking
12/30/1995	Railroad, Mile 82, Bearmouth, 23 car derailment	1 car had anhydrous ammonia, others non-hazardous	N/A	Montana Rail Link $350,000 damages
09/20/1996	MT Highway 1	Diesel	90 gallons	N/A
12/20/1997	I-90, Mile 137	Diesel	50 gallons	Transco, Inc.
04/07/1998	Drummond, Helmville Road	Diesel	10 gallons	Cenex

[33] National Response Center database. 2005. http://www.nrc.uscg.mil/foia.html.

Table X. Hazardous Materials Incidents in Granite County[33] (continued)

Date	Location	Substance	Quantity	Responsible Party
03/07/1999	Mine at Phosphate I-90 Exit	Waste Oil, Antifreeze, and Asbestos dumped	N/A	Tri-Square Construction
01/05/2004	Drummond City Sub-station	PBC Mineral Oil	1.5 gallons	Northwestern Energy
08/22/2005	Drummond High School	Hydraulic Oil	N/A	Mastodon Sand and Gravel

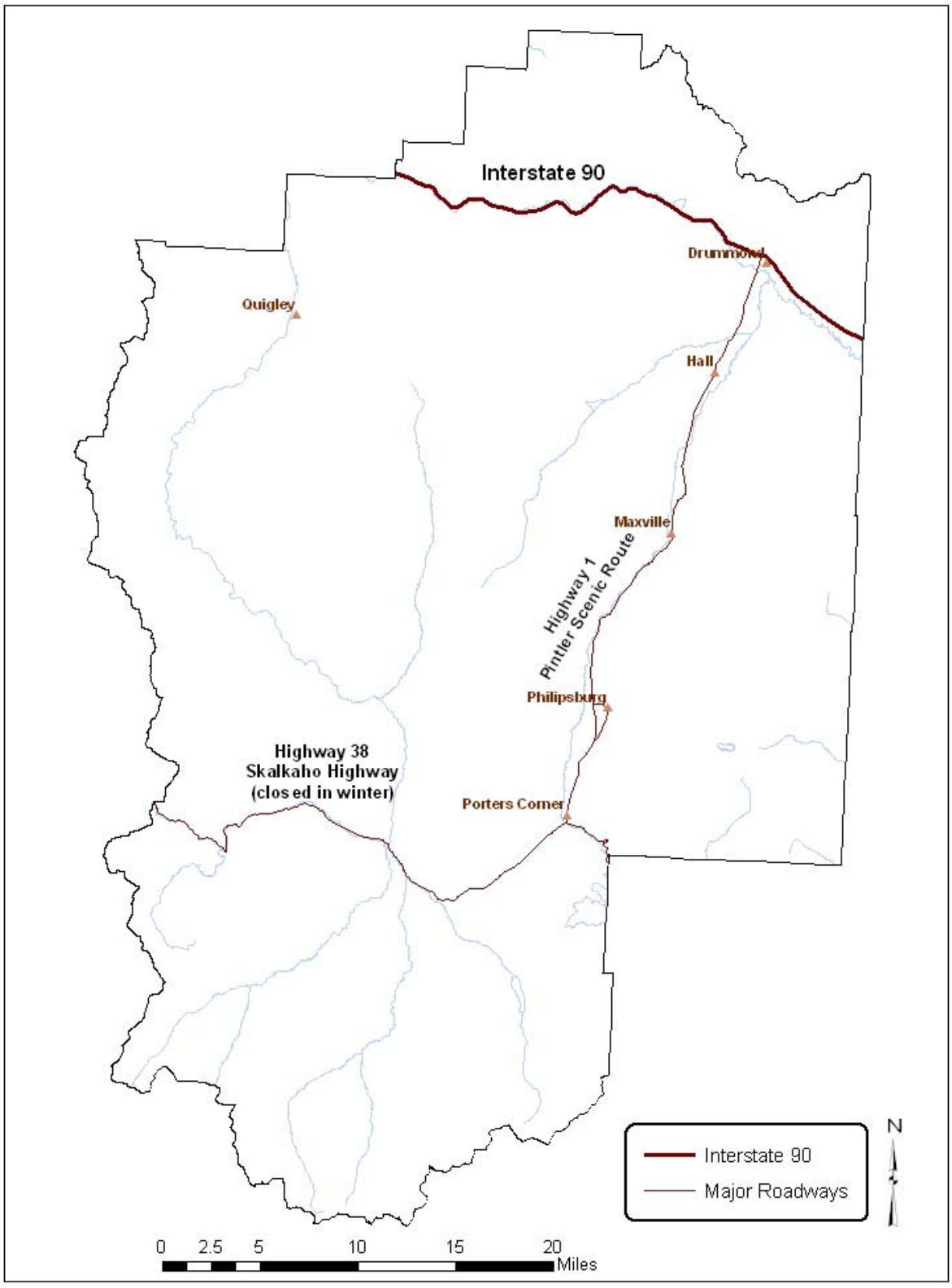
Probability

The probability of a hazardous materials release can only be realistically assessed qualitatively. The history of events in Granite County is moderate with 13 events over the past 15 years, none of which have resulted in a disaster declaration. Eleven of those 13 events occurred in Drummond or along the Interstate 90 corridor. The exposure is moderate to high in the Drummond area with Interstate 90, the railroad, and the Yellowstone Pipeline passing within close proximity to critical facilities and vulnerable populations. Therefore, the probability of a hazardous materials release that would require a significant government and public response is considered moderate in Drummond and northern Granite County and low in Philipsburg and southern Granite County.

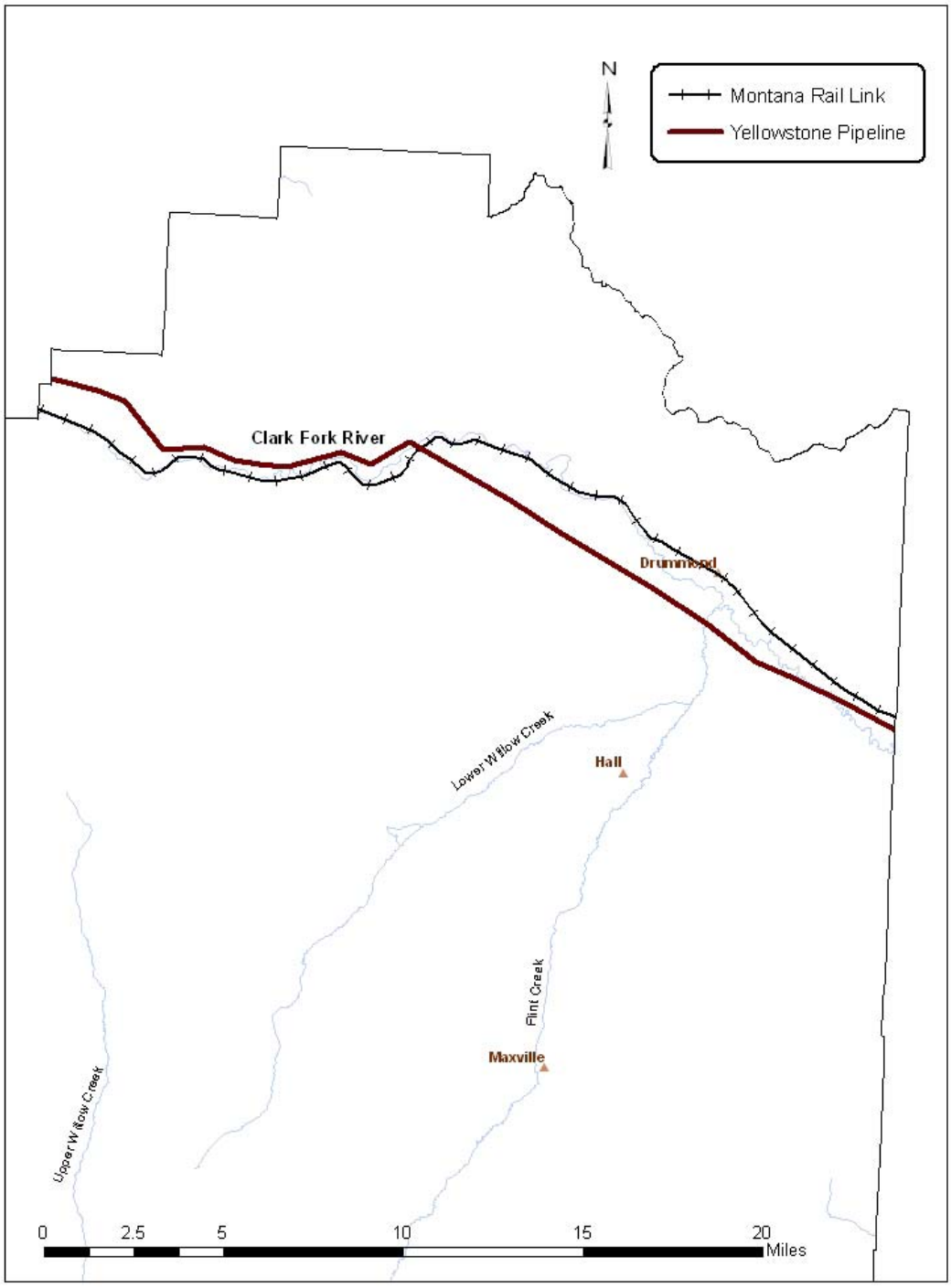
Mapping

Map 4.52 shows the major roadways transporting hazardous materials and Map 4.53 shows the active railroads and Yellowstone Pipeline in Granite County.

Map 4.52 Primary Hazardous Materials Transportation Routes in Granite County

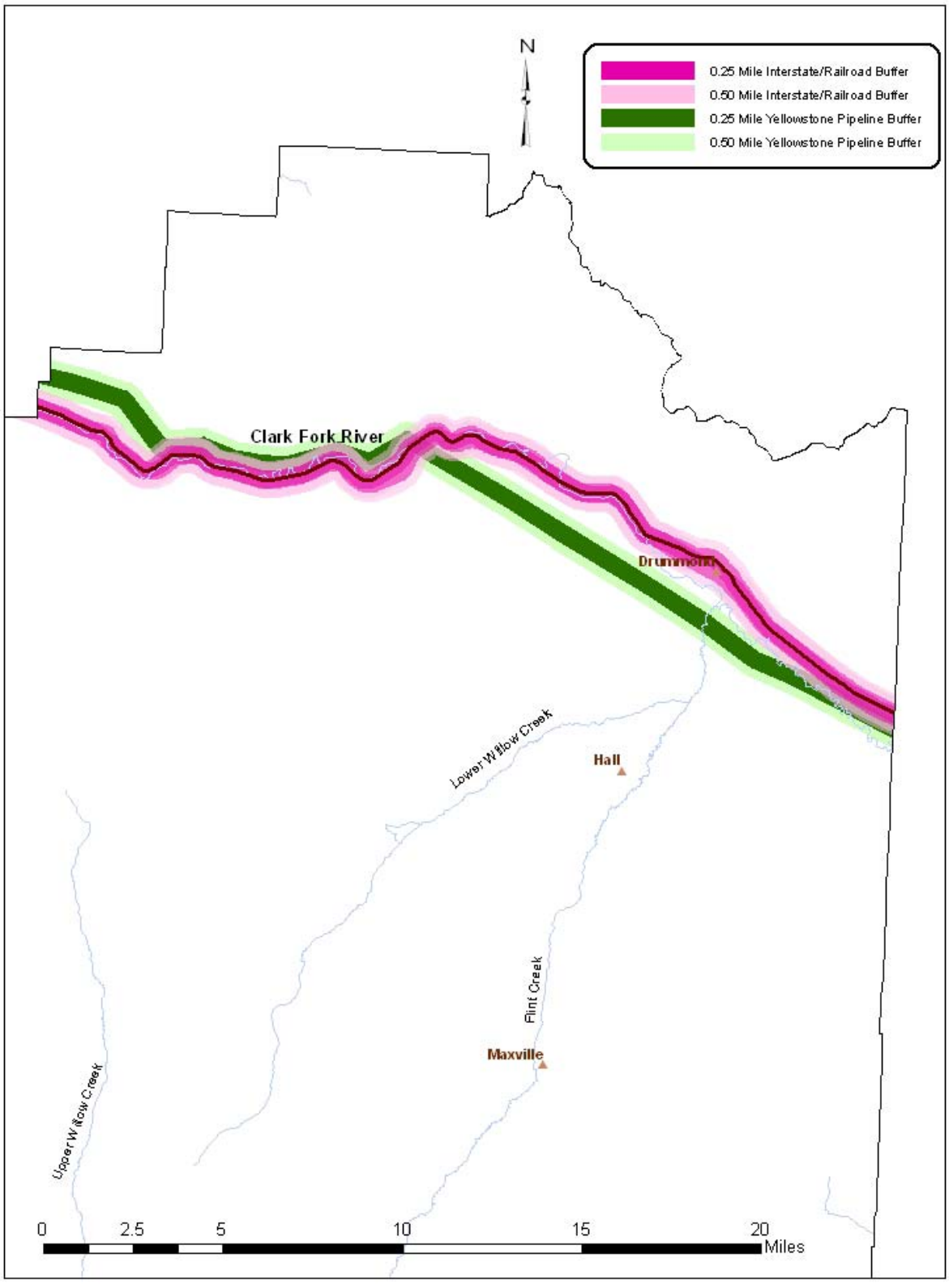


Map 4.53 Active Railroad and the Yellowstone Pipeline



As with many hazards, the degree of risk to a particular area is hard to quantify, however, buffer zones were created around the major hazardous materials transportation routes and the Yellowstone Pipeline to show the areas that would most likely be affected in a hazardous materials incident. Of course, the entire county is at some risk for a hazardous material release, but the areas shown in Map 4.54 are at the greatest risk given their proximity to areas where hazardous materials can typically be found.

Map 4.54 Hazardous Materials Release High Hazard Areas



Associated Hazards and Other Factors

Hazardous material releases can be accidental or intentional. Accidental causes can be due to a ground, air, or railroad accident. Almost any other hazard event may also lead to a hazardous material release. Destruction of a facility or transportation infrastructure may lead to a hazardous material release. Examples of hazards that may case such an event include earthquake, flooding, wildfire, avalanche, landslide, dam failure, severe thunderstorm, tornado, wind, structure fire, or even a volcano. Intentional releases may be related to terrorism or a domestic disturbance. A hazardous material release, if severe enough, could lead to civil unrest, a fiery explosion, or utility failure. With the potential for a hazardous material release to be caused by another event, the release could certainly aggravate the situation.

Vulnerability

Critical Facilities

The buffers around the highways and railways represent the areas that are at an enhanced risk for a hazardous materials release. Two buffer zones were established, 0.25 miles and 0.50 miles from the route. These buffer zones were chosen based on minimum evacuation radii that would be established for a typical hazardous substance release. Of course, the actual evacuation zone for an event is highly dependent on many factors including wind speed, wind direction, material released, and quantity released. Like many of the other hazards, the hazard area in an actual event will not involve the entire area at risk, but more likely a small section of the identified area, and therefore, a small percentage of the critical facilities and other structures. Based on these buffer zones, the following critical facilities and vulnerable populations are at risk.

Within 0.25 miles of Interstate 90 and/or the Railroad:

- Drummond Town Hall and Library
- Drummond Ambulance
- Valley Rural Fire District/Drummond Fire
- Drummond Water Tower/Well House
- Drummond Sewage Lift Station
- Drummond Post Office
- Montana Department of Transportation Weigh Station, Drummond
- Montana Department of Transportation Loader Shed, Clinton
- Blackfoot Telephone Substation, Drummond
- Qwest Telephone Substation
- Cenex Bulk Plant, Drummond
- Drummond Multi-Purpose Center/American Legion
- Drummond Elementary School
- Drummond High School

Within 0.25 miles of the Yellowstone Pipeline:

- Ravena Repeater Site (possible future site)
- Montana Department of Transportation Clinton Loader Shed

Within 0.25-0.50 miles of Interstate 90 and/or Railroad:

- Northwestern Energy Substations, South Main Street, Drummond
- Drummond Refuse Site

Within 0.25-0.50 miles of the Yellowstone Pipeline:

- Beacon 42 Repeater Site (possible future site)
- Montana Department of Transportation, Highway 1, Drummond Maintenance Site
- Qwest Telephone Substation, Drummond
- Yellowstone Pipeline Substation

Potential Losses

Using the same methodology as was used for the critical facilities, the structures were evaluated with respect to the highway, railroad, and pipeline buffer zones. The following estimates demonstrate the exposure of structures to hazardous materials incidents.

- 296 structures are within 0.25 miles of the interstate and/or railroad
- 22 structures are within 0.25 miles of the Yellowstone Pipeline
- 36 structures are within 0.25-0.50 miles of the interstate and/or railroad
- 30 structures are within 0.25-0.50 miles of the Yellowstone Pipeline

Fortunately, unless an explosion is present with the release, structures are typically not damaged in a hazardous materials release.

Potential Population Impacts

The population impacts from a hazardous materials release are more significant than the potential structure losses. Depending on the material, the health impacts to the public can be long and short term. Should a release occur in Drummond, the population impacts would be much greater than if one occurred in a more rural area.

Estimating the population to be roughly 1.03 people per structure (2,830 total population / 2,735 total structures), the population exposure can be estimated as follows:

- 305 people live and/or work within 0.25 miles of the interstate and/or railroad
- 23 people live and/or work within 0.25 miles of the Yellowstone Pipeline
- 342 people live and/or work within 0.50 miles of the interstate and/or railroad
- 54 people live and/or work within 0.50 miles of the Yellowstone Pipeline
- Drummond Elementary School has approximately 140 students plus staff
- Drummond High School has approximately 85 students plus staff

In a hazardous materials release, those in the immediate area would have little to no warning, whereas, the population in the dispersion path may have some time to evacuate, depending on the weather conditions and material released.

Impact of Future Development

Future development should have very little impact on this hazard for now. Currently the growth in Granite County is primarily taking place away from the railroads and highways. Should development occur in the area of the interstate, railroad, or pipeline, however, the population exposure to hazardous materials would significantly increase. The Granite County Subdivision Regulations specifically list areas of severe toxic or hazardous waste exposure as unsuitable for development without mitigation.

Data Limitations

Understanding when, where, and what substances are mostly likely to be released in an incident is the greatest limitation in analyzing this hazard. So many substances pass through Granite County without incident that fully describing how a release may occur and what population and structures may be affected is not possible. A study of the number and types of hazardous materials passing through Granite County would help better frame this profile.

TERRORISM

Description

Terrorism and civil disorders are human caused hazards that are intentional and often planned. Terrorism, both domestic and international, is a violent act done to try and influence government or the population of some political or social objective. Terrorist acts can come in many recognized forms or may be more subtle using untraditional methods. The primary recognized forms of terrorism are chemical, explosive, biological, radiological, and cyber.

Chemical terrorism is the use of chemical agents to poison, kill, or incapacitate the population. Chemical agents can be broke into five different categories: nerve agents, vesicants, cyanide, pulmonary agents, and incapacitating agents. Known nerve agents include tabun, sarin, soman, GF, and VX and can cause a variety of conditions affecting the central nervous system either in vapor or liquid form. Vesicants cause blisters on the skin and can damage eyes, airways, and other tissues and organs. Vesicant agents include sulfur mustard, Lewisite, and phosgene oxime. Cyanides can be in solid salt or volatile liquid format, or when combined with acid, a vapor or gas. Their absorption can cause everything from nausea to death, depending on the amount absorbed. Pulmonary agents such as phosgene and perfluroroisobutylene cause pulmonary edema usually hours after exposure. Incapacitating agents produce reversible disturbances with the central nervous system and cognitive abilities and include the agent BZ.[34]

Terrorism using explosive and incendiary devices includes bombs and any other technique that creates an explosive, destructive effect. Bombs can take many forms from a car bomb to a mail bomb to any suspicious package. They are often designed to blend in with the environment and not appear to be unusual. Bombs can be physically triggered like in the case of a suicide bomb or remotely detonated.

Bioterrorism is the use of biological agents to infect the population or animals with disease. The agents/diseases that the Centers for Disease Control and Prevention consider the highest priority due to their threat to the population and national security include anthrax, botulism, plague, smallpox, tularemia, and viral hemorrhagic fevers.[35] Bioterrorism could also be used against our livestock population and agricultural plants. The following are select animal diseases identified by the USDA as a severe threat to livestock and human health: Avian Influenza, Exotic Newcastle Disease, Nipah, Hendra, Eastern Equine Encephalitis, Venezuelan Equine Encephalomyelitis, Foot and Mouth Disease, Rift Valley Fever, Rinderpest, African Swine Fever, and Classical Swine Fever. Those plant diseases identified by the USDA as a severe threat to plants are: Soybean Rust, Southern Bacteria Wilt, Plum Pox, Downy Mildew of Corn, Brown Stripe Downey Mildew of Maize, Potato Wart, Bacterial Leaf Streak of Rice, Citrus Greening, and Pierce's Disease.[36]

Radiological terrorism involves the use of radiological dispersal devices or nuclear facilities to attack the population. Exposure to radiation can cause radiation sickness, long-term illness, and even death. Terrorism experts fear the use of explosive and radiological devices in the form of a "dirty bomb" to

[34] Sidell, Frederick R., M.D. Chemical Agent Terrorism. http://www.nbc-med.org/SiteContent/MedRef/OnlineRef/Other/chagter.html.
[35] Centers for Disease Control and Prevention. http://www.cdc.gov/.
[36] US Government Accountability Office. Homeland Security: Much Is Being Done to Protect Agriculture from a Terrorist Attack, but Important Challenges Remain. March 2005.

attack the population. As with chemical and biological events, radiological incidents present contamination challenges for first responders.

Cyberterrorism is the attack or hijack of the information technology infrastructure that is critical to the US security or economy through financial networks, government systems, mass media, or other systems. Any cyber attack that creates national unrest or instability would be considered cyberterrorism.

Montana has traditionally attracted activist/extremist individuals and groups because of its low population and large geographic area. Groups active in Montana vary from white supremacists to single issue groups, such as environmental extremists. These groups are attracted to the state and many of them view Montana as their “home" or safe haven. Because of these views, they commit their illegal activities outside of the state. An example of this would be the Unabomber, Ted Kaczynski. Kaczynski advocated the destruction of technology and the protection of the environment. The Unabomber was responsible for sixteen bombings and three deaths around the United States. He produced mail bombs from his home in Montana and sent them to individuals in other states.

Another example, *The World Church of the Creator,* which is a white supremacist group with a national following, advocates a “Racial Holy War” against minorities. This group has their national meeting in Superior, Montana once a year. Members of this group have been responsible for numerous homicides in the United States.

Groups such as the Phineas Priesthood of Spokane, WA used western Montana as a place to hide. The anti-government group, the Freemen, conducted an eighty-one day standoff with law enforcement in eastern Montana. At the conclusion it was determined they were a “refuge” for individuals around the country involved in criminal anti-government activity. Several of these individuals had spoken about military type action against the current government. Many other organizations besides these that have the potential to use violence exist in parts of Montana and across the country.

Granite County, Philipsburg, and Drummond are home to many events throughout the year. Those that occur annually and involve a large group of people include:

- Annual Rib Cook-Off in Philipsburg (May) – 1 Day
- Mule Days in Drummond (June) – 3 Days
- Miner’s Union Day Picnic in Philipsburg (June) – 1 Day
- Drummond Kiwanis PRCA Rodeo in Drummond (July) – 1 Day
- Four by Four Rally – A cross-county dogsled race (July) – 5 Days
- Flint Creek Valley Days in Philipsburg (July) – 3 Days
- Art and Jazz on Broadway in Philipsburg (July) – 1 Day
- Rock Mountain Accordion Celebration in Philipsburg (August) – 3 Days
- Writers in the Round in Philipsburg (August) – 1 Day
- Art and Jazz on Broadway in Philipsburg (August) – 1 Day
- Antique Tractors and Quilt Day in Drummond (October) – 1 Day
- Yule Night on Broadway in Philipsburg (December) – 1 Day

History

Fortunately, Granite County has not been the target of any major terrorist attacks.

Probability

With very little experience and data locally on this hazard, a specific probability is hard to determine. Based on the historical record and the terrorism threat present for the area, the probability of a large scale terrorism or civil disturbance event is considered low.

Mapping

Domestic and international terrorism can be hard to predict, and therefore, specific targets are not easily identified. The critical facilities are determined to be at greatest risk due to their importance in sustaining government services.

Associated Hazards and Other Factors

Any hazard that can be "created" can be the result of terrorism. For example, dam failure can be the result of a terrorist act of compromising the dam. Other examples include communicable disease, aviation, ground, and railroad accidents, hazardous materials release, utility failure, wildfire, and urban fire. All of these hazards could be the result of a terrorist act, if intentionally triggered.

Vulnerability

Critical Facilities

Critical facilities in Granite County are considered to be at greatest risk from terrorism. Often, terrorists target facilities that are highly important for government services and community stability or are particularly vulnerable. Threat data is not specific enough to identify what facilities are most vulnerable, therefore, all critical facilities are considered to have the same risk countywide.

Potential Losses

Structure losses are possible from terrorism and civil disorders but are not likely. Often the losses are at critical facilities or to the population. Looting, however, can be commonly found in association with these types of events. Therefore, this hazard places both the population and property at risk. Urban areas and places of public gathering are generally going to be the areas of greatest risk.

Potential Population Impacts

The effects of terrorism are usually felt by the population. The greatest risk is to human lives during times of attack. Terrorists typically try to make a dramatic impact that will generate media interest. Attacking the population through a large loss of life is a common tactic. Therefore, the greatest vulnerability from terrorism is to human life and the economy.

Impact of Future Development

Development should have little to no impact on the terrorism hazard, except for the increase in population and the increased potential for life and property losses should an event occur. The location of the development should have little effect on any events.

Data Limitations

Since terrorism is historically isolated to large cities and little history exists in Granite County, the probability and potential losses are difficult to quantify. Therefore, generalities have been made to estimate where potential losses could be.

TRANSPORTATION ACCIDENT

Description

In Granite County, a transportation accident, for the purposes of this plan, includes any large scale vehicular, railroad, or aircraft accident involving mass casualties. The most likely locations for a vehicular incident of this magnitude would be on Interstate 90 or on Highway 1. The Interstate is widely used by large trucks and distance travelers. Highway 1, also known as the Pintlar Scenic Route, provides a scenic alternative to Interstate 90. Both Interstate 90 and Highway 1 can become very treacherous during winter storms.

Montana Rail Link (MRL) operates on a railroad that crosses Granite County in an east-west direction, roughly parallel to Interstate 90, and passes through the Town of Drummond. MRL is a Federal Railroad Administration Class II regional railroad with more than 900 miles of track serving 100 stations in the states of Montana, Idaho and Washington, and employs approximately 1,000 people. They operate a fleet of more than 2,100 freight cars and 120 locomotives.[37] MRL connects with Spokane, Washington, the Burlington Northern & Santa Fe Railway (BNSF) at Laurel and Helena, Montana, the Montana Western Railway at Garrison, Montana, and the Union Pacific Railroad at Sandpoint, Idaho. The active railroad through Granite County could experience a derailment or collision at any time of year. The significance of such incidents depends on the location, number of cars derailed, and the type and release of materials onboard.

Aviation accidents can occur for a multitude of reasons from mechanical failure to poor weather conditions to intentional causes. Accidents can vary from small single engine aircraft to large commercial jets. The location of the accident, such as a remote area versus a populated location, also plays an important role in the amount of destruction caused. Granite County has two small airports, Riddick Field (U05), 1 mile south of Philipsburg at an elevation of 5,212 feet, and Drummond Airport (M26), southwest of Drummond at an elevation of 4,245 feet. Both airports serve non-commercial, private commuter, and recreational aircraft. Commercial service is provided at a number of area airports, primarily Butte, Missoula, and Helena. Large passenger aircraft serving these airports and those traversing the region often fly over Granite County. Small aircraft accidents may be relatively minor in nature involving none or few casualties, whereas, a large commercial aircraft could create a mass casualty incident requiring outside assistance.

History

Many motor vehicle accidents occur each year in Granite County, and occasionally fatalities do occur, but a major incident requiring a significant emergency response only occurs on occasion. In the mid 1980's, residents recall a bus accident on Highway 1, 6 miles north of Philipsburg, in which 6-7 people were injured.

Railroad accidents also occur on occasion. Table 4.55 outlines the accidents in Granite County documented by the Federal Railroad Administration since 1975.

[37] Montana Rail Link. 2005. http://www.montanarail.com/.

Table 4.55 Railroad Accidents in Granite County, Montana since 1975[38]

Year	# of Accidents	Fatalities	Injuries	Damages
1975	1	0	0	$8,040
1976	3	0	1	$136,051
1977	1	0	0	$20,379
1978	2	0	1	$19,800
1979	1	0	0	$112,600
1980	1	0	0	$257,300
1981	1	0	0	$99,550
1982	1	0	0	$239,500
1984	1	0	0	$115,500
1985	1	0	0	$257,700
1986	1	0	0	$33,825
1991	2	0	0	$242,000
1993	1	0	0	$10,500
1995	2	0	0	$451,000
1996	1	0	0	$78,000
1998	1	0	0	$300,000
TOTAL	21	0	2	$2,381,745

Table 4.56 briefly summarizes the accident reports filed by the National Transportation Safety Board as occurring in Granite County.

Table 4.56 NTSB Incident Report Summary for Aircraft Accidents in Granite County[39]

Date	Casualties	Cause
May 25, 1967	None	Plane experienced cylinder failure and landed in a ditch in Drummond
March 25, 1968	None	Plane rolled on landing in Maxville
January 25, 1970	None	Wings iced on a flight from Butte to Missoula and plane landed in trees when unable to clear a mountain ridge near Drummond
February 25, 1971	None	Flight from Kalispell to Billings experienced engine failure, landed on highway, and went into ditch near Drummond
August 6, 1971	None	Aircraft collided with fence on takeoff in wet, high grass in Drummond
October 2, 1971	None	Flight from Townsend forgot to put landing gear down at airport in Philipsburg
May 20, 1972	None	Due to poor pilot planning, aircraft fell short of airport in Drummond
March 18, 1974	None	Flight going from Oregon to Missoula encountered bad weather and landed on a frozen lake near Philipsburg
September 19, 1978	4 fatal	Flight from Missoula to Bozeman crashed in poor weather conditions, pilot was not instrument rated

Residents also recall a military B-52 crash on Stewart Ridge during the late 1950's. The number of casualties are unknown.

[38] Federal Railroad Administration, Office of Safety Analysis. http://safetydata.fra.dot.gov/officeofsafety/Default.asp.
[39] National Transportation Safety Board database. 2005. http://www.ntsb.gov/.

Probability

The probability of a major transportation accident is considered moderate based on the historical occurrence and the variety of transportation means used in the county. The probability of a large vehicle wreck with mass casualties is further increased during the frequent snow storms, periods of poor visibility with blowing snow or smoke, and during times of heavy tourist traffic.

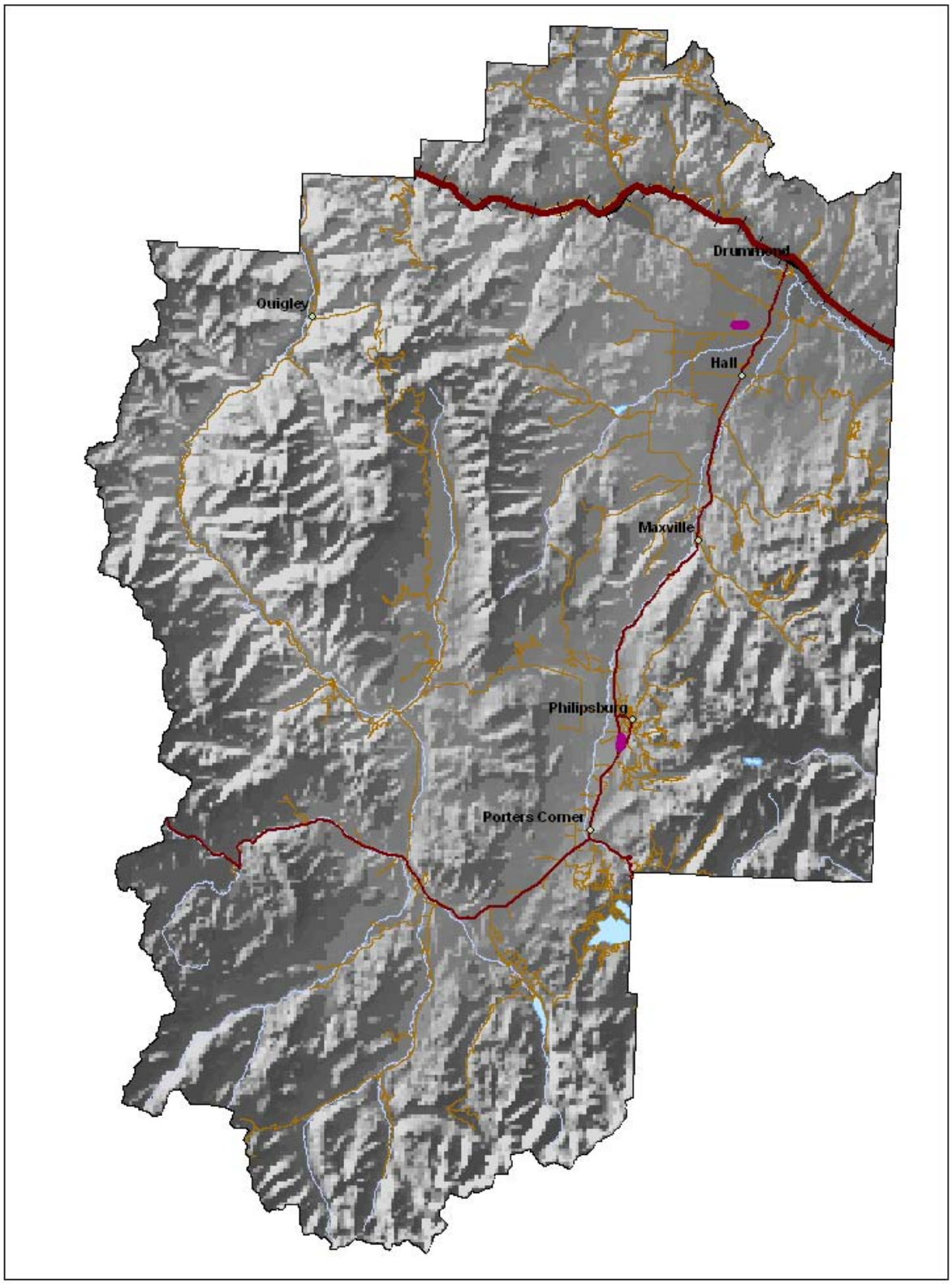
Since 1975, 21 railroad accidents have occurred resulting in $2,381,745 in track and equipment damages and 2 injuries. Using this historical record, on average, a railroad accident occurs 0.70 times per year (21 accidents / 30 years). The average accident causes $113,416 ($2,381,745 / 21 accidents) in damage. The annualized damage total is roughly $79,392 ($2,381,745 / 30 years). Another important consideration in a railroad accident is the release of hazardous materials. Fortunately, none of the railroad accidents to date have involved hazardous materials.

As the historical record demonstrates, the probability for a private, small aircraft accident is much greater than one involving a large commercial jet in Granite County. Although an incident involving a commercial passenger flight and mass casualties cannot be ruled out, the probability is considered low. Since 1968, 4 fatalities from aircraft accidents have occurred in Granite County and a total of 9 incidents have been recorded by NTSB. Based on these statistics over a 37-year period (1968-2004), a ten-year average can be derived. In an average ten-year period, 2.4 aircraft incidents causing damage can be expected involving 1.1 fatalities.

Mapping

Map 4.57 shows the road network, railroad, and airports in Granite County. The entire county is at risk for aircraft accidents and vehicular crashes. The areas within close proximity to the railroad are at risk from railroad accidents.

Map 4.57 Transportation Routes in Granite County



Associated Hazards and Other Factors

The additional hazards associated with transportation accidents are the obvious concerns for hazardous material releases. Any transportation accident involving the transport of hazardous materials increases the complexity and potential damages from that accident. Some hazards may even cause transportation accidents such as winter storms, wildfires, earthquakes, severe thunderstorms, and strong winds. Almost any hazard can cause or aggravate a transportation mass casualty incident, especially extreme cold and strong winds.

Vulnerability

Critical Facilities

All critical facilities in Granite County are considered to be at some risk from transportation accidents. Given the nature of historical events and the probability of a specific facility being hit, the overall vulnerability of any given critical facility is considered very low. The only infrastructure that can be considered at a slightly higher risk are the roadways and power lines, given their typical proximity to transportation accidents.

Potential Losses

Potential losses from a transportation accident include vehicular losses, property damages, and roadway damage. Should vehicle fluids or hazardous materials seep into a water supply, that water body would also be threatened. Typically, most losses from transportation accidents are covered by insurance. Should the incident be large enough, the greatest expenditures would probably be in responding agency costs. Should structures be affected, damages could vary in the hundreds of thousands of dollars depending on the structure or structures impacted. Should an accident occur in a developed area, structural losses in the neighborhood of $156,600 (2 homes x $78,300/average home) plus ground casualties could be found. A large commercial jet crash could potentially destroy an entire segment of a populated area for a loss of roughly $783,000 (assuming approximately 10 structures were destroyed). Additional losses, including potential economic losses, could result during a mass casualty incident of this magnitude. The likelihood of such an high magnitude accident is extremely low.

Potential Population Impacts

Population losses are highly likely in transportation accidents. Transportation accidents have the potential to kill and injure large numbers of people. Any accident involving a bus, commercial aircraft, or many vehicles has the potential for casualties numbering from 10 to 200. Therefore, the potential for large population losses is considered moderate.

Impact of Future Development

Future development, except for the associated increase in vehicles in the area, will not impact or will just slightly increase the probability of a major transportation accident. Otherwise, the specific

locations of where development occurs should not significantly affect the vulnerabilities from this hazard.

Data Limitations

Data regarding transportation hazards is varied between government agencies. The documented history of vehicle accidents is limited to fire department records. Detailed records on mass casualty incidents should be considered for county use. The data on the railroad accidents is from the Federal Railroad Administration. This data is sufficient in calculating the occurrence over the past 30 years. Where the data is not useful is in determining the probability of a large-scale accident involving hazardous materials. An analysis of the current railroad weaknesses, numbers and types of materials transported, and areas with the greatest potential for derailment would enhance this profile. Such information, however, would not necessarily be included in a public plan. The National Transportation Safety Board keeps very detailed records of damaging aircraft incidents. These records allow for in-depth analysis of individual accidents. The randomness of aircraft accidents, however, limits the usefulness of such information in determining the potential for losses and areas of greatest hazard. Data outlining the number of aircraft passing over Granite County and the areas they typically traverse would help to quantify the potential for additional major accidents.

UTILITY and COMMUNICATIONS FAILURE

Description

Utility and communications outages can be caused by almost any of the hazards described in this risk assessment, but they can also occur because of human error or equipment failures. Electric, gas, telephone, and water services are all important services that could become problematic should a long term outage occur. Electricity is used to power many homes in Granite County and is used to pump wells and run heating systems even if not the primary fuel source. Therefore, if electricity was lost for a long period of time, many residents could be without heat, water, and other appliances. Vulnerable populations needing powered medical equipment would be additionally threatened by a long term power outage. Natural gas is used as a heat source for many residents in the larger Granite County communities, including Philipsburg and Drummond. Should that utility be lost in the winter months, the concerns associated with extended cold would be of particular concern. Telephone services are most critical for 911 communications. Residents would lose their ability to call 911 in an emergency if telephone service was lost. Usually, cell phone service is lost too since the towers communicate through phone lines. Water services are provided through public water systems in the communities of Philipsburg and Drummond. Should those services be lost, many citizens would be without water and possibly sewer services. Any of these disruptions can be easily managed if the outage is only for a short time but can quickly become problematic in long term situations.

History

Short term power outages occur regularly. Residents recall following a heavy wet snowfall on June 4, 2001, power to many Northwestern Energy residents was out for about 10 days. Ten inches of snow was recorded in Drummond. Residents recall 40 inches in Granite County, but that amount could not be verified through climate data but is plausible at some of the higher elevations.

Probability

Due to the lack of major historical events, the probability of a significant utility outage in Granite County is considered low. While the demand on our public utilities and communications is increasing, the technology and protection of that infrastructure is also improving. Should an event occur in Granite County, the probability that other counties or the entire region would be affected is high.

Mapping

Digital mapping of the Granite County utility infrastructure is not readily available as the county does not have a GIS function. Electric, gas, and telephone infrastructure mapping is maintained by the private owners of the systems. As standard policy, this data is for internal use only. The location of key infrastructure is withheld to prevent malicious use of such sensitive data.

Associated Hazards and Other Factors

Utility failures can be caused by many of the hazards described in these profiles. Anything from an earthquake to a terrorist event could cause utilities to fail. Events that utility systems are particularly

vulnerable to include earthquakes, floods, severe thunderstorms, tornadoes, high winds, winter storms, wildfires, and dam breaks. Underground water systems can crack during earthquakes or freeze in cold weather. The water supply is particularly vulnerable to contamination from flood waters or wildfire silt runoff. Above ground electric and telephone infrastructure is vulnerable to high winds, heavy snow loads, wildfire, and terrorism. Most natural gas lines are buried and are vulnerable to cracking during an earthquake.

Vulnerability

Critical Facilities

Critical facilities are vulnerable to utility outages. Most of the facilities would have limited functionality without electricity, in particular the Granite County Sheriff's Office/911 Center. Most critical facilities, except for those in the outlying areas, are connected to the public water system. Disruption of telephone services would limit emergency communications to radio and satellite transmissions. Of particular concern are the shelters in a long term utility outage, particularly if one occurs during an extended cold weather period.

Potential Losses

Utility failures typically do not impact structures directly. Services to residential and commercial buildings could be lost, and therefore the functionality of the water and heating systems may be disrupted. One of the greatest losses would be to the economy. Many businesses require electricity, water, and telephone services to operate. Should a utility failure extend for several days, the business losses could be significant. Roughly 54% of the county's economy is retail trade with an additional 7% in accommodations and food service. This sector of the economy could be severely impacted by a utility outage.

Potential Population Impacts

Without public utility services such as heat and drinking water, the population could suffer and at a minimum be inconvenienced. Significant casualties would not be expected since these services would possibly be available in a nearby community. If not, outside resources could be reasonably expected within a few days before serious impacts of the utility loss were felt by the majority of the public. Residents are encouraged to keep extra water supplies and basic disaster supplies kits on hand. Significant relocations of vulnerable populations and disruption of normal lifestyles would be expected.

Impact of Future Development

Future development is not expected to have significant impacts on this hazard. Increased populations add to the challenges of managing a long term utility outage but would not increase the damages necessarily.

Data Limitations

Since long term utility outages are not a normal event for Granite County, understanding the specific problems and concerns of this hazard are the greatest limitation. The lack of utility mapping available for analysis also limits evaluating the probability of a utility failure and the potential areas that could be affected.

VOLCANIC ASH

Description

Active volcanoes are not present in Granite County, but past eruptions have affected the county, and the possibility of an eruption in Yellowstone National Park always exists. The active volcanic areas in the Cascade Range such as Mt. St. Helens, Mt. Rainer, and Mt. Hood are hundreds of miles to the west of Granite County but are still within reasonable range of ash fall, especially considering the usual upper atmospheric wind patterns. Theoretically, these volcanoes could deposit ash several inches thick over Granite County, and any large eruption could change the weather patterns experienced globally.

Yellowstone, one of the world's largest active volcanic systems, has produced several giant volcanic eruptions in the past few million years, as well as many smaller eruptions and steam explosions more recently. Although no eruptions of lava or volcanic ash have occurred for many thousands of years, future eruptions are likely. In the next few hundred years, hazards will most probably be limited to ongoing geyser and hot-spring activity, occasional steam explosions, and moderate to large earthquakes. To better understand Yellowstone's volcano and earthquake hazards and to help protect the public, the U.S. Geological Survey, the University of Utah, and Yellowstone National Park formed the Yellowstone Volcano Observatory, which continuously monitors activity in the region.[40]

If a large caldera-forming eruption were to occur at Yellowstone, its effects would be worldwide. Thick ash deposits would bury vast areas of the United States, and injection of huge volumes of volcanic gases into the atmosphere could drastically affect global climate. Fortunately, the Yellowstone volcanic system shows no signs that it is headed toward such an eruption. The probability of a large caldera-forming eruption within the next few thousand years is exceedingly low. Any renewed volcanic activity at Yellowstone would most likely take the form of non-explosive lava eruptions. An eruption of lava could cause widespread havoc in the park, including fires and the loss of roads and facilities, but more distant areas would probably remain largely unaffected.[40]

History

In May 1980, the eruption of Mount St. Helens sent ash high into the atmosphere. Approximately two inches of ash fell across Granite County. Public offices, including the schools, were closed, and the public was recommended not to drive and to wear respirators when outside.

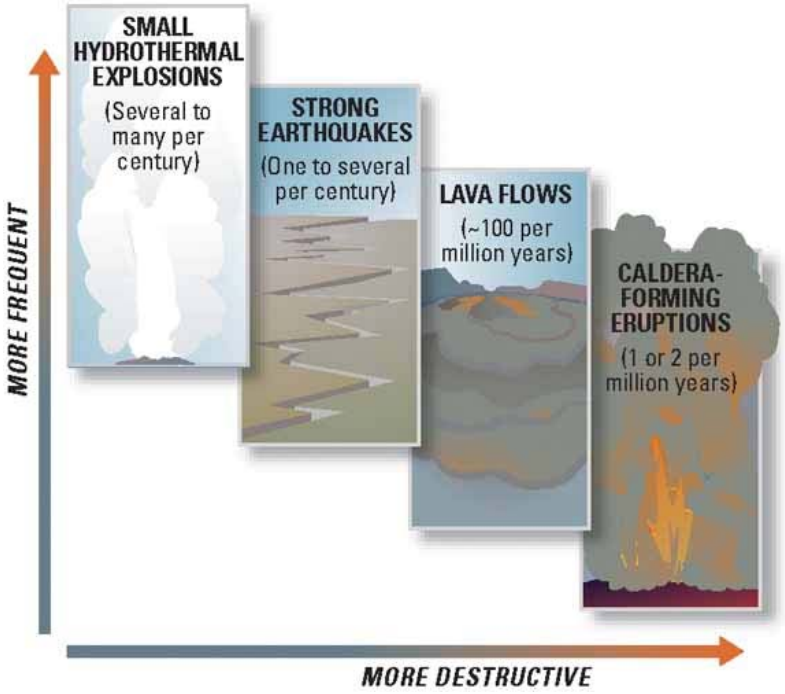
Historical studies have shown that ash from Glacier Peak 11,200 years ago and Mount Mazama 6,600 years ago also fell in Granite County.[11] The Yellowstone region has produced three exceedingly large volcanic eruptions in the past 2.1 million years. In each of these cataclysmic events, enormous volumes of magma erupted at the surface and into the atmosphere as mixtures of red-hot pumice, volcanic ash (small, jagged fragments of volcanic glass and rock), and gas that spread as pyroclastic ("fire-broken") flows in all directions. Rapid withdrawal of such large volumes of magma from the subsurface then caused the ground to collapse, swallowing overlying mountains and creating broad cauldron-shaped volcanic depressions called "calderas."[40]

[40] US Geological Survey. Fact Sheet 2005-3024, Steam Explosions, Earthquakes, and Volcanic Eruptions – What's in Yellowstone's Future?. 2005.

Probability

Volcanic eruptions are rare events when considered in comparison to other hazards measured on the 100-year scale. The Montana Hazard/Vulnerability Analysis from 1987 estimates the return period of substantial volcanic ash fallout in Granite County to generally once every 5,000-8,000 years.[11] Scientists evaluate natural-hazard levels by combining their knowledge of the frequency and the severity of hazardous events. In the Yellowstone region, damaging hydrothermal explosions and earthquakes can occur several times a century. Lava flows and small volcanic eruptions occur only rarely - none in the past 70,000 years. Massive caldera-forming eruptions, though the most potentially devastating of Yellowstone's hazards, are extremely rare - only three have occurred in the past several million years. U.S. Geological Survey, University of Utah, and National Park Service scientists with the Yellowstone Volcano Observatory (YVO) see no evidence that another such cataclysmic eruption will occur at Yellowstone in the foreseeable future. Recurrence intervals of these events are neither regular nor predictable.[40] Figure 4.58 shows the probability of the various events that can occur in Yellowstone National Park.

Figure 4.58 USGS Graphic Depicting Recurrence Intervals for Geological Events in Yellowstone National Park[40]



Mapping

The areas affected by volcanic eruptions are dependent on the type of eruption and the prevailing wind direction. In an actual event, models would be used to estimate the areas predicted to receive ash and other effects from the volcano. Therefore, mapping hazard areas would be broad generalizations and will not be completed here.

Associated Hazards and Other Factors

Volcanoes, a geological feature, are closely related to earthquake activity. Often eruptions are preceded by earthquake activity as magma moves below the surface. The two events are usually closely linked and monitored. Other factors that become important during a volcanic eruption including wind speed, direction, and rainfall. The wind speed and direction will dictate when and where ash falls. Dry ash is manageable, but when combined with rainfall, the ash becomes glue-like and much more difficult to control.

Vulnerability

Critical Facilities

All critical facilities are at risk from volcanic eruptions. The impact on the facilities will depend on the amount of ash that falls and the ability to remove it. Significant amounts of ash have the potential to clog air systems and shut down facilities. Given enough wet, heavy ash, the potential exists for roofs to fail. Infrastructure exposed to the ash fall, such as power systems, could be brought down by the ash as well. The removal of ash from government facilities and infrastructure could potentially create costs beyond the community's capabilities.

Potential Losses

During Mt. St. Helens, most costs came from the difficult task of removing volcanic ash. The greatest threat is not necessarily to people or residences but to property such as vehicles and equipment. The volcanic dust is corrosive to metals and without proper removal can certainly cause damages to public and private property. The potential exists, although unlikely, that a large amount of ash, if combined with rainfall, could be heavy enough to collapse roofs and cause structural damage. The economy could also be negatively affected. In the case of Mount St. Helens, travel in Granite County was restricted while crews cleaned up.

Potential Population Impacts

Light ash fall does not typically impact the population. The first to be affected are usually the elderly and those with respiratory problems. Often the public is instructed to remain indoors with windows and doors closed. Should a heavy ash fall condition exist for several days, more significant health problems could result. Pyroclastic flows that can destroy everything in their paths would most likely not impact Granite County due to its distance from active volcanoes.

Impact of Future Development

Future development will have little to no effect on the volcano hazard vulnerability. An increase in the population and number of structures would increase the exposure.

Data Limitations

Volcanic eruptions that affect Granite County are so extremely rare that documenting the potential impacts and probability is very limited. Continued study of the Yellowstone caldera and other volcanic areas will hopefully allow scientists, and therefore emergency managers, to better understand this hazard.

WATER SUPPLY and WATERSHED CONTAMINATION

Description

Contamination of the watershed serving the public water systems in Granite County would leave many residents without clean water for drinking, cooking, or cleaning. Contamination could occur naturally through wildfire or intentionally through terrorism or vandalism. Specifically, Philipsburg is served by a public water system fed from Fred Burr Lake and Silver Springs. The number of users on this chlorinated system total 530. The system has 2 storage tanks that can hold 200,000 gallons each. This water supply is served by an exposed pipeline in an unpopulated area. This area is also at risk from wildfires. The sediment from a wildfire could easily clog the system or contaminate the water. Many residents outside the municipalities are served by individual wells, and ground water contamination could lead to well contamination.

History

Fortunately, the water supplies in Granite County have never been contaminated. The watershed serving Philipsburg has been threatened by wildfire in past years.

Probability

Due to the lack of major historical events, the probability of a significant water supply contamination in Granite County is considered low. Should a wildfire occur in the watershed serving Philipsburg, the probability that the water would become contaminated or the public water system would shut down is considered moderate to high.

Mapping

Digital mapping of the Granite County water systems is not readily available as the county does not have a GIS function. The location of key water system infrastructure is withheld to prevent malicious use of such sensitive data.

Associated Hazards and Other Factors

The primary hazards that could lead to water supply contamination are wildfire and terrorism. A hazardous materials release in any of the watersheds serving communities could also contaminate the public water supply.

Vulnerability

Critical Facilities

Critical facilities and vulnerable populations are vulnerable to water supply contamination. Their functionalities would be limited due to the lack of clean, running water. Given this scenario, however,

most facilities could still be utilized with drinking water considerations for workers. Loss to the water supply systems could be realized, but damages to other infrastructure are considered unlikely.

Potential Losses

Water supply contamination would not directly affect structures, but the functionality of businesses would be lost without water services for employees and customers. Should water contamination persist for several days, the business losses could be significant. Roughly 54% of the county's economy is retail trade with an additional 7% in accommodations and food service. This sector of the economy could be severely impacted by water contamination. Residents would lose the ability to drink water, shower, clean, and cook many foods in their homes due to water contamination.

Potential Population Impacts

The affected population could receive alternative water supplies from neighboring communities to supplement their basic water needs. Should assistance be limited, however, the population could be displaced. During the recognition period of the contamination, residents may become sickened until boil orders or contamination notifications are made. The Philipsburg water system serves 530 users. The population impacts from this hazard are considered moderate.

Impact of Future Development

Future development is not expected to have significant impacts on this hazard. Increased populations add to the challenges of managing a long term utility water outage but would not increase the damages necessarily. The subdivision regulations specifically list areas with polluted or non-potable water supply as unsuitable for development without mitigation.

Data Limitations

Since the water supplies in Granite County have never been contaminated, the potential losses and anticipated impacts are hard to quantify.

WILDFIRE

Description

Wildland fires are a part of nature in the mountainous, forested areas and arid grasslands of Montana. Granite County has both broad areas of National Forests and dry open fields. Forest fires can travel quickly through the crowns of trees or spread along the forest floor. Grass fires are common in non-irrigated fields and open areas scattered with sage brush and native grasses due to the arid climate during almost any season but winter.

A wildland fire can be categorized as either an uncontrolled fire in a forested/heavily vegetated area or in a grass/brush area. Both types of wildfires have the potential to destroy structures and natural resources while producing heavy amounts of smoke. Wildfires can be caused by any flame source but are most often triggered by lightning, human carelessness, arson, or train sparks. Once triggered, the ambient conditions dictate whether the fire will spread or not. Moist, cool, calm conditions or low fuels will suppress the fire, whereas dry, warm, windy conditions or heavy fuels will contribute to fire spread. The natural environment has evolved to live with fire. New growth occurs in a matter of a few years and some species require fire to grow.

Problems with wildfire occur when combined with the human environment. People and structures near wildfires are threatened unless adequately protected through evacuation or mitigation. Most structures are flammable, and therefore, are threatened when wildfire approaches. In addition, a significant loss of life could occur with residents who do not evacuate, firefighters, and others who are in the wildfire area. Infrastructure such as electric transmission lines, fuel tanks, and radio transmission towers are not often equipped to withstand the heat from a wildfire. Timber resources, animal habitats, and waterways can all be damaged leading to negative economic and environmental impacts. The area where human development meets undeveloped, vegetative lands is called the wildland/urban interface (WUI). A more detailed definition of the WUI in Granite County can be found in their Community Wildfire Protection Plan[41].

Granite County is regularly threatened by wildfires because of the terrain, climate conditions, and fuels present. Granite County has a large area of government owned lands, national forests in particular. Parts of the Philipsburg District of the Beaverhead National Forest and the Missoula District of the Lolo National Forest are within the Granite County borders. The US Bureau of Land Management, Montana Department of Natural Resources and Conservation, and Montana Fish, Wildlife & Parks manage many parcels of land within the county as well.

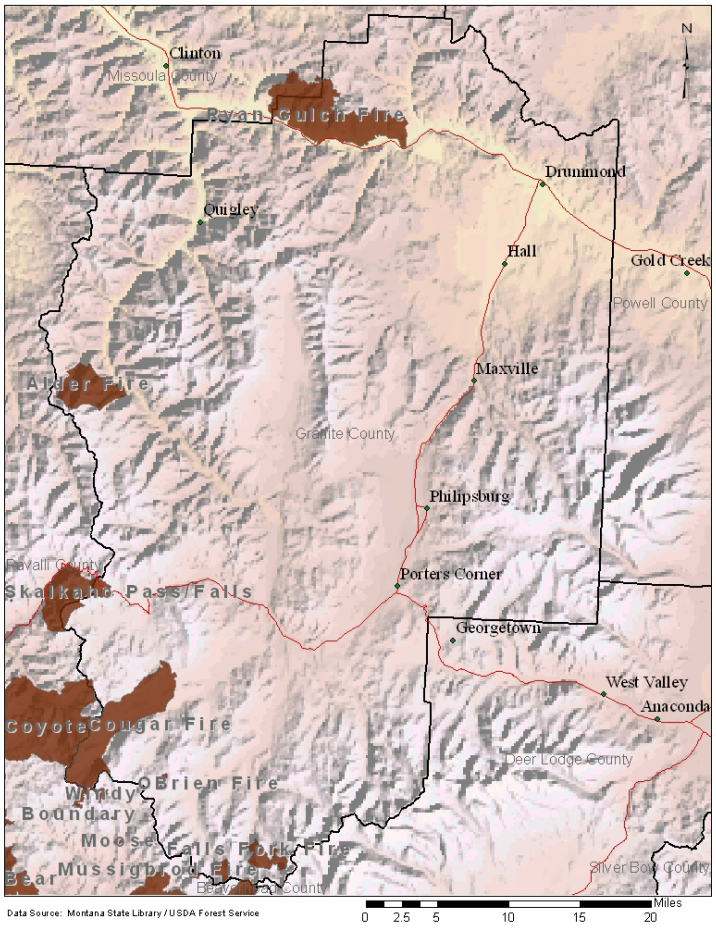
Fuels in Granite County range from dense timber stands in varying terrain to native grasslands. Douglas fir, lodgepole pine, Engelmann spruce, sagebrush, rough fescue, and other grasses make up many of the wildland fuels in the county. Periods of drought, disease, insect infestations, and low fire activity or suppression may all lead to an increase in hazardous fuels.

[41] FoxLogic, LLC. First Final Draft, Community Wildfire Protection Plan (CWPP), Granite County, Montana. October 2005.

History

Granite County has a long history of wildfires from small to large. Some have caused damages and others have not. The extent of damages often depend on the fire spread rate and the effectiveness of suppression and mitigation measures. The history of wildfires can be difficult to compile because of the various firefighting entities involved and a variety of recordkeeping measures over the years. The draft Granite County Community Wildfire Protection Plan (CWPP)[41] complied statistics from the federal and state firefighting agencies. The federal database, recording wildfires since 1968, does not allow for queries by county, and therefore, the USFS Beaverhead-Deerlodge National Forest Deer Lodge Resource District and the Bureau of Land Management Butte and Missoula Districts were queried. These statistics represent a regional area, including but not limited to, Granite County. Using this data and the data gathered from Montana Department of Natural Resources dating to 1981, the CWPP states that 3,106 fires have burned 199,351 acres in the greater Granite County area. "The majority of fires occurred in the month of August, were most often caused by lightning, were usually less than one acre in size, and generally lasted less than one day before being extinguished. A combined analysis of federal agency and the MT DNRC data indicates 65 percent of fires were caused by lightning and remaining 35 percent were human caused. Of the total human-caused fires, an alarming 46% were caused by escaped debris burning fires."[41] The 1988 and 2000 wildfire seasons were particularly significant in Montana. Map 4.59 shows the areas in and around Granite County burned in 2000.

Map 4.59 2000 Wildfire Season Burn Areas in Granite County, Montana



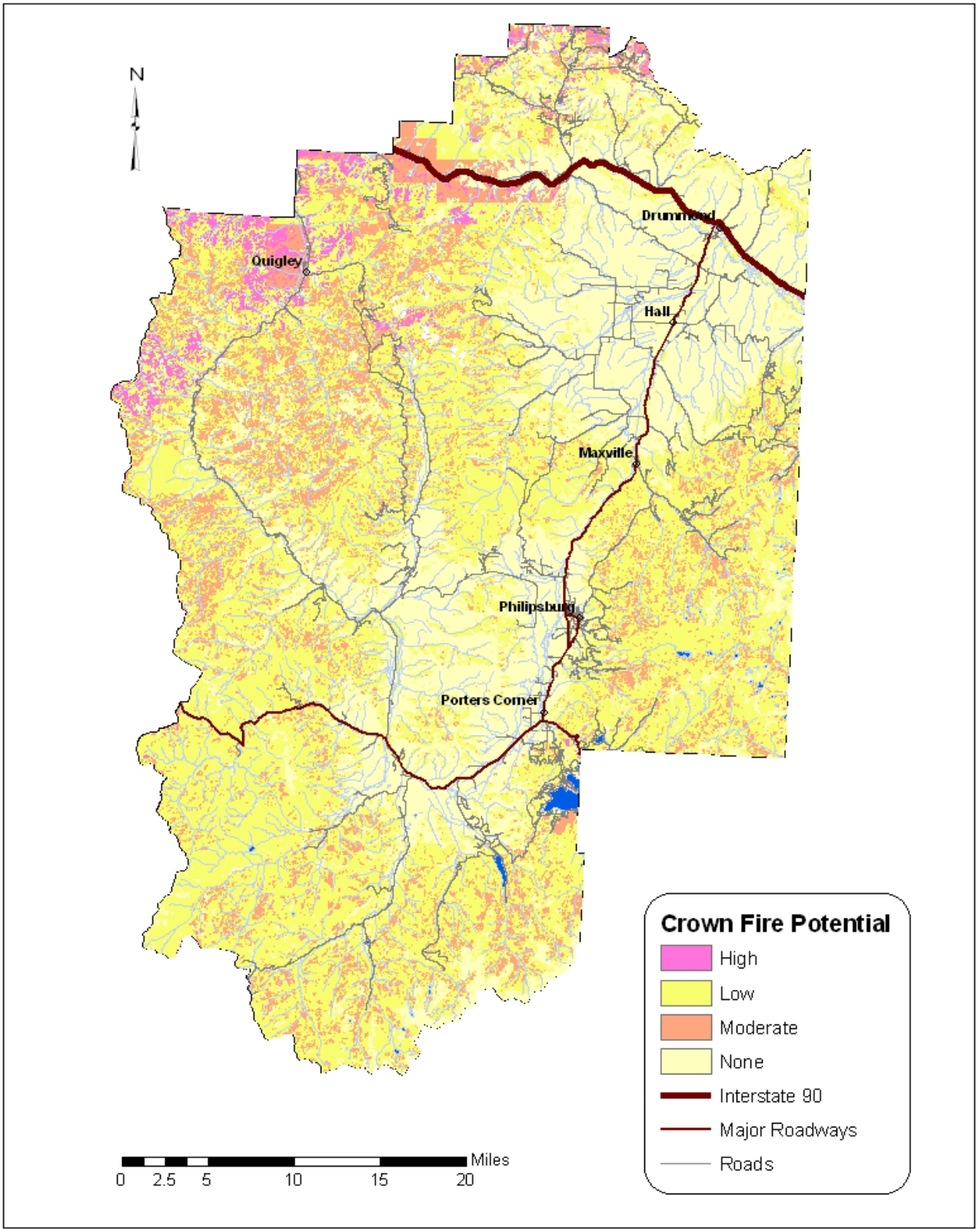
Probability

Since 1968, 3,106 wildfires have been recorded in the greater Granite County area. Years of fire suppression have resulted in unnatural, heavy fuel conditions. Homes and summer camps have popped up in forested areas where none used to be. Therefore, the probability of a damaging wildfire appears to be increasing. Using the historical record, the estimate of wildfires in the Granite County area, based on averages, is roughly 84 fires per year (3,106 fires/37 years). The majority of these fires are less than an acre and do not threaten property. Given the right meteorological and fuel conditions, however, any fire can grow into a major wildfire. A map of the Ignition Probabilities can be found in Figure 7 of the Community Wildfire Protection Plan.[41]

Mapping

Map 4.60 shows the crown fire potential in areas identified by the US Forest Service. The US Forest Service has found that the potential for damaging wildfires is most directly related to the crown fire potential. Therefore, the map shows the estimated risk for areas within the county. This mapping was primarily done for Forest Service areas, and therefore, other parts of the County may be additionally threatened and not mapped. A Community Wildfire Protection Plan currently under development contains a better assessment of the hazard areas.

Map 4.60 Crown Fire Potential in Granite County



Data Source: US Forest Service

Associated Hazards and Other Factors

As if a raging wildfire isn't bad enough, the charred ground and thick smoke plumes it produces can create other hazards. The heavy smoke produced by a wildfire can cause unhealthy air conditions that may affect those with respiratory problems and otherwise healthy people. The air conditions are often monitored and alerts may be issued. Smoky conditions can also lead to poor visibility and an increased probability of ground transportation or aircraft accidents. Besides air pollution, water pollution may also occur during and after a wildfire. Many watersheds in wildland areas serve as the public water supplies for area communities. Should a significant wildfire pass through the area, pollution of the watershed can occur. With vegetation removed and the ground seared from a wildfire, the area also becomes more prone to flash floods because of the ground's reduced ability to hold water. Wildfires can have an impact on the regional economy with the loss of timber, natural resources, recreational opportunities, and tourism, all of which are of particular importance in Granite County.

Vulnerability

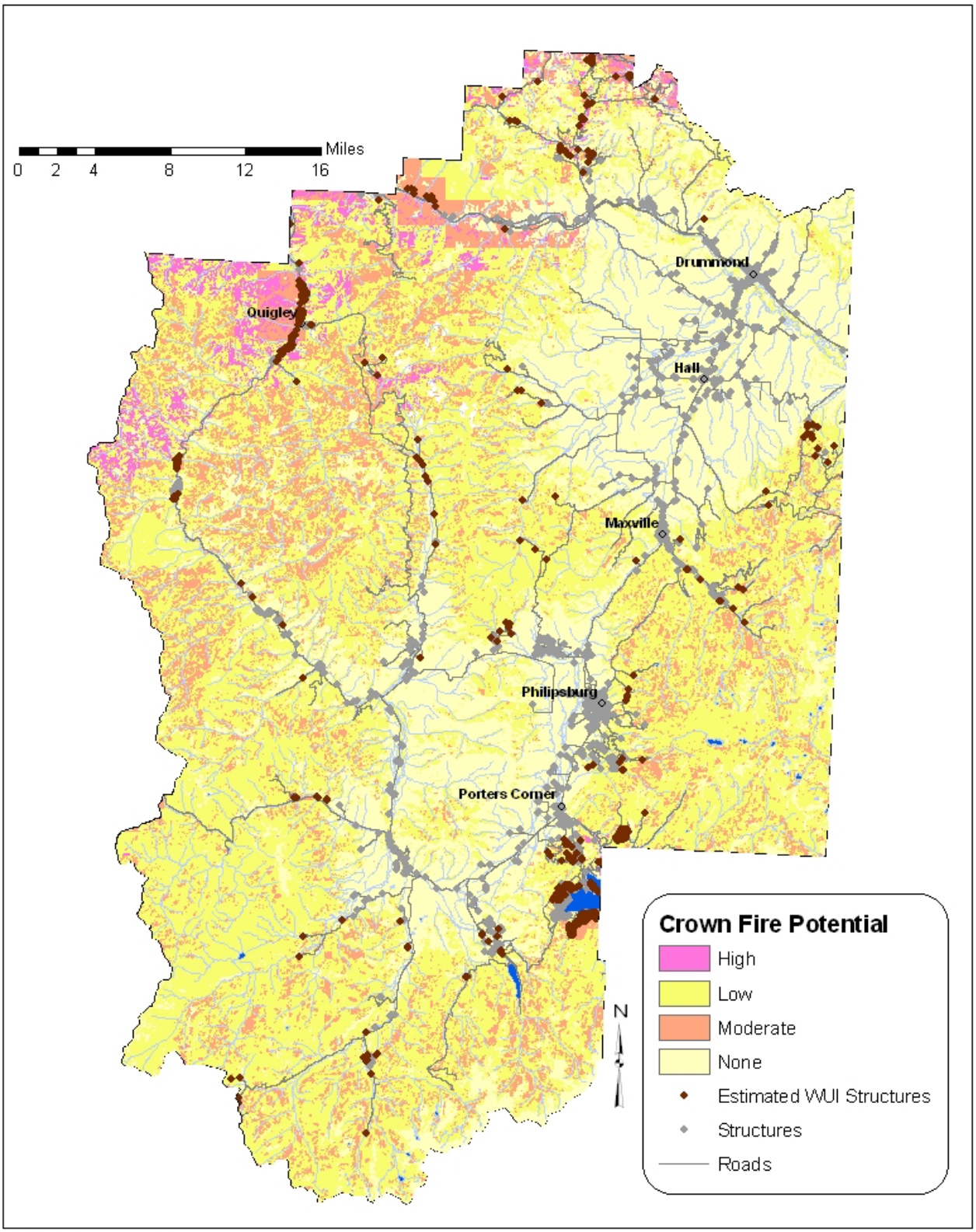
Critical Facilities

The critical facilities in the wildland urban interface with crown fire potential include the Georgetown Lake Fire Stations (one each in Deer Lodge and Granite Counties), Philipsburg Water Facility, Philipsburg Power Facility (Gonq Road), Flint Creek Hydroelectric Plant, Lolo National Forest Rock Creek Ranger Station, Montana Department of Transportation Clinton Loader Shed, Qwest Telephone Substation, Slide Rock Repeater Site, and Rumsey Mountain Repeater Site. These facilities are at a greater risk for being damaged or have their functionality lost during a wildfire.

Potential Losses

Wildfires have the greatest potential to substantially burn National Forests, however, private residences become threatened when the fire enters the wildland/urban interface. Granite County has many wildland/urban interface areas that may be threatened should a wildfire encroach. Using the crown fire potential map in conjunction with structure data, an estimate of the number of structures in the interface was derived. Those structures within, in close proximity to, or accessed through high or moderate crown potential areas were estimated to be in the wildland/urban interface. Using this methodology, approximately 659 structures are located in the wildland/urban interface (WUI), as shown in Map 4.61. Of the 659 structures, 9 are businesses, 330 are seasonal dwellings/cabins, 12 are general purpose or government use, 221 are houses, and 87 are mobile homes. Note that this figure is purely an estimate based on available GIS data.

Map 4.61 Estimated Wildland/Urban Interface Structures in Granite County



Data Source: US Forest Service
MaPS, Inc. under contract by Granite County

The total value of these structures is estimated at $54,992,891 (659 structures * $83,449/structure in unincorporated areas of Granite County). As Map 4.61 shows, the WUI areas are widespread across the county. A damage factor is rather difficult to determine because the losses will be highly dependent on the fire characteristics and its location. Not all areas will be affected by one wildfire. Losses in the area of the WUI fire, however, could have a high loss rate. Given the assumption that 15% of the structures in the total WUI could be lost in a probable wildfire, the structure losses from that fire would roughly total $8.2 million dollars with 99 structures affected.

A 1994 WUI Assessment conducted for the Montana Department of Natural Resources and Conservation ranked the following subdivisions (in priority order) by risk level:[41]

Very High
- Beavertail
- Georgetown Lake West
- Georgetown Lake South
- Eagle Canyon
- Maxville

High
- Upper Willow Creek
- Bearmouth
- Philipsburg

Moderate
- Gillies Bridge

Although the primary concern is to structures and the interface residents, most of the costs associated with fires come from firefighting efforts. Additional losses to natural resources, water supplies, air quality, and the economy are also typically found. As past events have also shown, infrastructure such as power transmission lines can be threatened. The Community Wildfire Protection Plan[41] estimates the total taxable value of the county's commercial forest land is $115,068,584.25 (192,021 acres * $599.25/acre). Again, using a damage factor of 15%, the timber losses can be estimated at $17,260,287.63.

Potential Population Impacts

Using the estimate of 99 structures affected in a major wildfire from the Potential Losses section, roughly 102 people would live in the affected area (99 structures x 1.03 people/structure). In many cases, residents can be evacuated before the fire moves into their area. Some residents, however, may choose to remain in the evacuated area or a rapidly spreading fire may not allow enough time for a formal evacuation. Firefighters can also be particularly threatened during wildfires. For these reasons, the impact on the population can be considered moderate.

Impact of Future Development

The wildland/urban interface is a very popular place to live as national trends show. More and more homes are being placed in this interface, particularly in Montana, and Granite County is no exception. Development in the hazard areas has increased in recent years and has amplified the vulnerabilities in the unincorporated parts of Granite County significantly. Regulating growth in these areas is a delicate balance between protecting private property rights and promoting public safety.

Currently, the Granite County Subdivision Regulations[5] require two entrance/exit roads and bridges must conform to the Granite County Bridge Standards. Structures are prohibited on slopes greater than 25% and on specific topographical features ("fire chimneys"). The minimum lot sizes are shown in Table 4.62

Table 4.62 Wildfire Minimum Lot Sizes

% Slope	Open Grass	Forest & Brush
0-10	1 acre	2 acres
10-20	2 acres	3 acres
20-25	3 acres	4 acres
Over 25	5 acres	Not permitted

Subdivisions must also meet the water supply requirements set forth by the local fire protection authority or as stated in Section IV-A-16:

- A central water system with a minimum flow of:
  - 500 gallons/minute for densities of 2 homes/acre or less
  - 750 gallons/minute for densities of 2 homes/acre or more

- With no central water system:
  - Cisterns, reservoirs, or fill ponds with a minimum storage capacity of 2,500 gallons per residence.

- Both supplies must:
  - Be within 10 feet of fire truck access
  - Provide a dry hydrant or an electric pump with a reliable backup generator

In areas considered to be high fire hazard areas by the local fire protection authority, US Forest Service, or Montana Department of Natural Resources and Conservation, the subdivision must additionally meet the following requirements as stated in Section IV-A-17:

- Road right of way shall be cleared of slash
- Open space, park land and recreation areas (including green belts, riding or hiking trails) should be located, where appropriate, to separate residences and other buildings from densely forested areas.
- Densities in areas of steep slopes or dense forest growth shall be reduced through minimum lot standards shown in Table 4.63.

Table 4.63 High Wildfire Hazard Area Minimum Lot Standards

% Slope	Open Grass	Forest & Brush
0-10	1 acre	2 acres
10-20	2 acres	3 acres
20-25	3 acres	4 acres
Over 25	5 acres	Not permitted, unless specifically authorized by Granite County

Data Limitations

The wildland/urban interface can be defined in many ways to included areas of flammable grasses or steep slopes. For the purposes of this analysis, areas with the potential for crown fires were used to define the interface. A more detailed study, using field analysis techniques, would allow for better wildland/urban interface exposure and potential loss estimates. Granite County is currently writing a Community Wildfire Protection Plan[41] that will better outline the wildfire hazard.

WIND, TORNADOES, and SEVERE THUNDERSTORMS

Description

Thunderstorms in Montana develop when moisture in the air rises, often from daytime ground heating, an unstable atmospheric condition, synoptic front, or by terrain uplift, and cools higher in the atmosphere, condensing into rain droplets or ice crystals. The cloud grows as these conditions continue and the atmospheric instability allows. Lightning can be produced, with or without rain, as a charge builds up in the cloud. With the right atmospheric conditions, updrafts and downdrafts form in the thunderstorm structure. These strong updrafts and downdrafts can produce hail, strong straight-line winds, and even tornadoes.

Hail is produced when a supercooled droplet collects a layer of ice and continues to grow, sustained by the updraft. Once the hail stone cannot be held up any longer by the updraft, it falls to the ground. Granite County regularly has small, pea-sized hail, but larger stones to the size of quarters or larger are possible.

Strong straight-line winds, sometimes stronger than tornadoes at over 100 mph, occur when air is carried into a storm updraft, cools rapidly, and comes rushing to the ground. Cold air is denser than warm air, and therefore, wants to fall to the surface on warm summer days when the cold air can no longer be supported up by the storm's updraft. These winds are forced horizontally when they reach the ground and can cause significant damage.

Tornadoes form when the right amount of shear is present in the atmosphere and causes the updraft and downdraft to rotate. A funnel cloud is the rotating column of air extending out of a cloud base, but not yet touching the ground. The funnel cloud does not become a tornado until it touches the ground. Once in contact with the surface, it can create great damage over a small area. Although rare, they can and do occur in Montana.

A severe thunderstorm is defined by the National Weather Service as a thunderstorm that produces wind gusts at or greater than 58 mph, hail ¾" or larger, and/or tornadoes. Although not considered severe by definition, lightning and heavy rain can also accompany thunderstorms. The severe conditions are often the events that can directly cause widespread damage. Strong winds, hail, and tornadoes have the capability to damage structures, infrastructure, crops, livestock, and vehicles.

High winds can also occur outside thunderstorms with strong pressure gradients and gusty frontal passages. High wind warnings are issued when winds are expected to be sustained at 40 mph or greater for at least one hour or gusts of 58 mph or greater. Wind advisories are issued when sustained winds are expected at 30 mph or greater for at least one hour or longer or gusts over 45 mph.

History

Granite County has experienced tornadoes, high winds, and severe thunderstorms. A tornado, F0 on the Fujita scale, occurred on May 4, 1971 at 4:15PM near Hall. Another F0 tornado was reported August 11, 1988 at 7:00PM near Stoney Creek. The tornado's path was 2 miles long and 23 yards wide.

Table 4.64 documents the severe thunderstorm reports from Granite County.

Table 4.64 Granite County Severe Thunderstorm Reports[42]

Date	Location	Type	Size/Speed	Damages
06/06/1958	Granite County	Hail	0.75 inches	
11/16/1966	Granite County	Thunderstorm Wind	59 mph	
06/28/1982	Granite County	Thunderstorm Wind	Unknown	
08/11/1988	Granite County	Thunderstorm Wind	63 mph	
06/15/1989	Granite County	Thunderstorm Wind	Unknown	
08/01/1989	Granite County	Thunderstorm Wind	63 mph	
08/01/1996	Maxville	Hail	0.75 inches	
05/31/1997	Hall	Thunderstorm Wind	60 mph	
07/17/1997	8 miles SW of Philipsburg	Hail	1.00 inches	
07/17/1997	Georgetown Lake	Hail	0.88 inches	
08/07/1997	Maxville	Hail	1.00 inches	
09/15/1997	18 miles W of Philipsburg	Thunderstorm Wind	69 mph	8 acres of uprooted and snapped trees, 300 trees downed, near Mile 29 of Forest Road #29
07/03/1998	13 miles SW of Nimrod	Thunderstorm Wind	60 mph	Cottonwood and Douglas Fir trees uprooted
07/26/2000	15 miles S of Clinton	Thunderstorm Wind	60 mph	Downed trees
08/10/2000	30 miles SW of Philipsburg	Thunderstorm Wind	60 mph	Downed trees

Probability

The history of hail and strong thunderstorm winds in Granite County shows that both are fairly frequent. The data presented in the history is based on reports received by the National Weather Service in Missoula, MT. Therefore, many events may not have been reported or noted by observers. With the exception of tornadoes, recent data appears to be the most accurate, and therefore, the following statistics can be presented based on the data since 1988.

Tornadoes:

- 2 confirmed F0 tornadoes since 1971

Hail:

- 4 severe hail events since 1988
- Annual average = 0.24 events or 1 event every 4.25 years
- Largest reported size = 1.00 inches

[42] National Climatic Data Center. 2005. http://www.ncdc.noaa.gov/oa/ncdc.html.

Thunderstorm Winds:

- 8 severe thunderstorm wind events since 1988
- Annual average = 0.47 events or 1 event every 2.13 years
- Highest reported thunderstorm wind speed = 69 mph

Figures 4.65 and 4.66 show the frequency of severe thunderstorm events by month. June, July, and August are the months when most severe thunderstorms occur.

Figure 4.65 Hail Events, ¾" of Larger, in Granite County, by Month

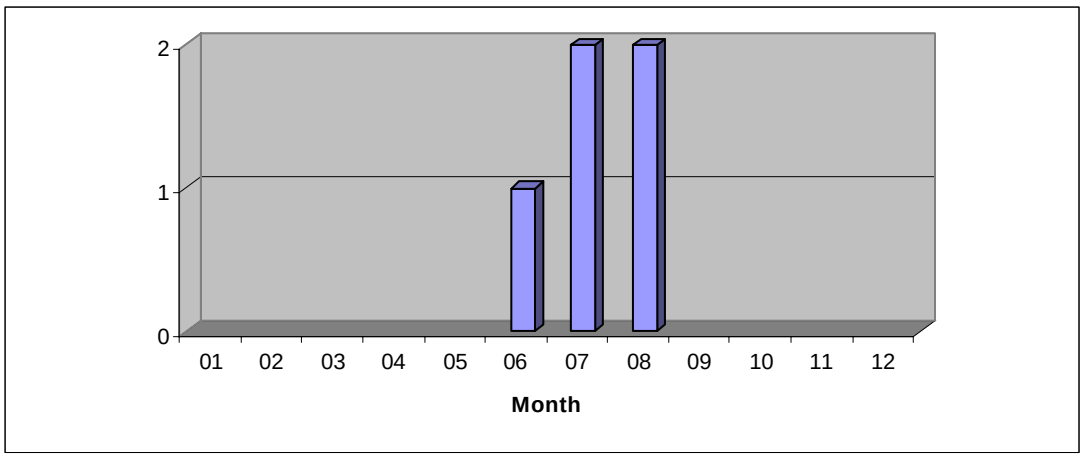
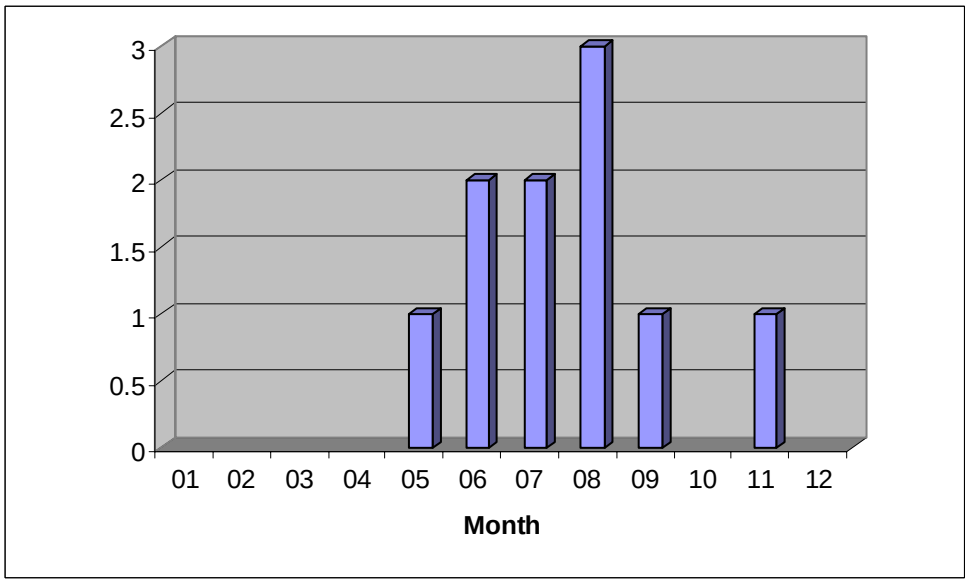


Figure 4.66 Thunderstorm Wind Events, 58 mph or Greater, in Granite County, by Month



Mapping

Severe thunderstorms can occur anywhere in Granite County. Due to the sporadic population centers in Granite County, mapping the locations of historical events would show where events have been spotted and reported from, but would not necessarily depict the hazard level from severe thunderstorms. Infrequently traveled areas may have a larger concentration of severe thunderstorm events, but because of the low population, events may have gone unreported.

Associated Hazards and Other Factors

Almost any other hazard can be aggravated by high winds. Wildfires and urban fires can spread more rapidly under high wind conditions. Drought conditions can be made worse by winds quickly evaporating ground moisture and causing soil erosion. Avalanches become more likely on wind loaded slopes. Aviation accidents are more likely to occur in windy conditions. Should a utility outage occur in the winter, home heat would be lost more quickly during windy conditions. Warm winds have even lead to more severe flooding by melting the snow pack quicker. Blizzard conditions from blowing and drifting snow can develop with the onset of strong winds. Large hail and tornadoes occur in severe thunderstorms, but frequent lightning often occurs with these storms. Lightning can cause structure fires, utility failure, and wildfires. Heavy rain is almost always found in severe thunderstorms, and therefore, flash flooding can be associated with the other severe events.

Vulnerability

Critical Facilities

All critical facilities are considered to have the same vulnerability to wind and severe thunderstorms. Infrastructure, namely power lines, is more vulnerable to high winds and falling trees. Power systems are the most likely type of infrastructure to fail during a severe thunderstorm. Communications towers may also topple under strong winds or large hail. Those critical facilities at a reduced risk from severe thunderstorms and tornadoes are those utilities located underground and within reinforced structures.

Potential Losses

With the entire county at risk from wind, severe thunderstorms, and tornadoes, estimates of damages are hard to determine. Realistically, an event involving a tornado or severe thunderstorm would most likely affect a small area. If that area, however, was in a developed part of the county, 10-20 homes could be damaged. Fifteen homes at a damage factor of 30% would result in roughly $352,350 in damages. Vehicles damaged by hail or falling debris would be additional losses. Potential losses could also include losses to agriculture. Livestock and crops can be significantly damaged by hail and wind and leading to diminished profits.

Potential Population Impacts

The National Weather Service in Missoula, MT warns for severe thunderstorms and tornadoes when recognized on Doppler radar or by other means. Some events have 15-20 minutes warning time and others have little to no warning. Depending on the warning issued and the area threatened, the population may or may not be at risk. The numerous campgrounds in the National Forests become particularly vulnerable populations unless the warnings are received and precautions are taken. A NOAA weather radio transmitters are located in Missoula and Butte and those with specially built receivers can be alerted to weather hazards. The signal strength in Granite County, however, is fairly weak.

Impact of Future Development

Future development will likely have little effect on the vulnerability to wind, severe thunderstorms, and tornadoes. The risk is assumed to uniform countywide, and therefore, the location of development does not increase or reduce the risk necessarily. Development and population growth may in fact improve the television and radio technology available to residents, and therefore, improve the warning capabilities.

Data Limitations

Wind, severe thunderstorms, and tornadoes can be such isolated and common events that the vulnerability to a particular area can be hard to determine. Weather data is often limited by the observations taken, and high wind, severe thunderstorm, and tornado events are only recorded if reported to the National Weather Service office. A long-term detailed study using radar analysis over Granite County could be used to determine the areas at greatest risk for severe thunderstorms. Additional anemometers spread throughout the county with archived data would allow for a more detailed wind analysis.

WINTER STORMS and EXTENDED COLD

Snow storms and bitterly cold temperatures are common occurrences in Granite County and generally do not cause any problems as residents are used to winter weather and are prepared for it. Snow falls regularly during all seasons, except summer, and roads become slippery quite often. Residents understand that this is part of living in Montana. Sometimes, however, blizzards can occur and overwhelm the ability to keep roads passable. Heavy snow and ice events, particularly late season events, have the potential to bring down power lines and trees. The extreme wind chills, often dropping below zero, may harm residents if unprotected outdoors or if heating mechanisms are disrupted. Table 4.67 lists the various National Weather Service winter weather warning criteria for Granite County.

Table 4.67 NWS Winter Weather Warning Criteria

Warning Type	Criteria
Blizzard Warning	Heavy snow or blowing snow (visibility less than 1/4 of a mile) and sustained winds or frequent wind gusts of 35 mph or more are expected for a period of several hours.
Heavy Snow Warning	Snowfall of at least 6 inches in 12 hours or 8 inches in 24 hours is expected. In the mountains above 6000 feet, snowfall of at least 8 inches in 12 hours or 12 inches in 24 hours.
Winter Storm Warning	Heavy snow and windy conditions, not meeting the blizzard warning criteria, are imminent or have a very high probability of occurring. A winter storm warning indicates a decent chance that the event will pose a threat to life and/or property.
Winter Storm Watch	Blizzard conditions, heavy snow, significant freezing rain, and/or heavy sleet are possible but its occurrence, location, and/or timing are still uncertain. Winter storm watches are typically issued 12 to 48 hours before an event is expected to begin.
Winter Weather Advisory	Winter weather is imminent or has a very high probability of occurrence, but the expected hazard does not meet warning criteria. Conditions are expected to cause significant inconvenience and, if caution is not exercised, could lead to situations that may threaten life and/or property. Examples of winter weather advisory conditions include visibility 1/4 mile or less, an ice accumulation which makes surfaces hazardous, and/or snow of 2-5" in 12 hours.
Winter Storm Outlook	Alert the public of the potential for a significant winter storm, in a 48 hour or beyond time span.
Wind Chill Warning	Wind chill temperatures of -20ºF or colder and winds of 10 mph or greater are expected for 3 hours or more.
Wind Chill Advisory	Wind chill temperatures of -10ºF or colder and winds of 10 mph or greater are expected for 3 hours or more.

History

Table 4.68 shows the winter weather records from various reporting stations in Granite County.

Table 4.68 Winter Weather Records for Granite County, Montana[2]

Location	Period of Record	Low Temperature Record	Daily Snowfall Record
Drummond	1929-2005	-48°F, January 26, 1957	16.5 inches
Philipsburg	1903-2005	-40°F, February 9, 1933	32 inches

Other notable events include June 1949 when Philipsburg received 28 inches of snow. In Granite County, cold air masses can settle into the valleys and stick around for many days. Residents recall two particularly severe events - early March 1989 when elk froze standing up and Drummond was struck particularly severely by the cold and February and March in the mid 1980's when many public water lines froze.

SHELDUS[43], a county level hazard database strongly encouraged by FEMA and its evaluators to be used in this plan, came up with many winter weather events for Granite County. Upon further inspection of the original data, the listings were determined to be inaccurate for the area and incorrectly listed for Granite County.

Probability

The probability of winter storms each season is almost a certainty. The probability of an event that overwhelms the community capabilities, though, is harder to determine. To date, Granite County has not had any winter weather events that have lead to a Presidential Disaster Declaration, but such an event is certainly possible and cannot be overlooked. Since significant winter weather is a common occurrence, the probability of a disastrous event is considered moderate.

Mapping

Across the county, Granite County is vulnerable to winter weather. Therefore, the risk assumed to be the same countywide.

Associated Hazards and Other Factors

Winter storms and extended cold can be associated with many other hazards. In particular, ground transportation accidents. Interstate 90 and other roadways can become hazardous very quickly during winter storms. Such incidents normally involve passenger vehicles, however, an incident involving a commercial vehicle transporting hazardous materials or a vulnerable population such as a school bus is also possible. Any hazard that causes a utility outage, such as an earthquake, during an extended cold period would present sheltering and cold weather exposure challenges. When combined with wind, blizzard conditions can quickly result. Urban firefighting efforts may also be more challenging during extreme cold temperatures due to frozen water lines. Heavy snow can alleviate drought conditions and

[43] Hazards Research Lab (2005). The Spatial Hazard Events and Losses Database for the United States, Version 3.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org.

improve forest health, thus decreasing the wildfire threat, but in doing so can often increase the probability of avalanches and riverine flooding come springtime.

Vulnerability

Critical Facilities

All critical facilities are assumed to have the same vulnerability from winter storms and cold temperatures. Those facilities with back-up generators are better equipped to handle a winter storm situation should the power go out. Otherwise, all are designed to withstand winter storms but may not be able to provide heat if electric service is lost.

Potential Losses

Snow in Granite County generally does not cause the communities to shut down or disrupt activities. Occasionally, though, extreme winter weather conditions can cause problems. The most common incidents in these conditions are motor vehicle accidents due to poor road conditions. These losses are usually covered by insurance. Losses to structures are typically minimal. Most structures are built to withstand reasonable snow loads in this region.

Potential Population Impacts

Since winter storms and cold spells typically do not cause major structural damage, the greatest threat to the population is the potential for utility failure during a cold spell. Although cold temperatures and snow are normal for Granite County, extremes can exist that would go beyond the capabilities of the community to handle. Should the temperatures drop below -15ºF for several weeks or several feet of snow fall in a short period of time, the magnitude of frozen water pipes and sewer lines or impassable streets could result in disastrous conditions for many people. If power lines were to fail due to snow/ice load, winds, or any other complicating factor, the situation would be compounded. In the event power or other utilities were disrupted, many homes could be without heat or water. With temperatures frequently dropping below zero in a typical winter, any event where heating systems failed could send many residents to shelters for protection. Other residents may try to heat their homes through alternative measures, and thereby, increase the chance for structure fires or carbon monoxide poisoning.

Sheltering of community members would present significant logistical problems when maintained over a period of more than a day. Transportation, communication, energy (electric, natural gas, and vehicle fuels), shelter supplies, medical care, food availability and preparation, and sanitation issues all become exceedingly difficult to manage in extreme weather conditions. Local government resources could be quickly overwhelmed. Mutual aid and state aid might be hard to receive due to the regional impact of this kind of event.

Impact of Future Development

Future development should have little to no impact from winter storms and extended cold weather. The most significant challenge may be, as homes go up in more remote parts of the county, to access those residents should sheltering or emergency services be needed in an extreme event.

Data Limitations

Since major winter weather incidents occur frequently, but typically do not cause damages, the biggest data limitation is in understanding the magnitude of an event that begins to cause problems and the associated impacts that challenge the local government. Records outlining the winter weather conditions (snow depth, temperature, wind, snowfall rates, water content, and duration) and the problems (number of accidents, condition of roadways, and services needed) would increase the local understanding of this hazard.

Risk Assessment Summary

This risk assessment represents an approximate history and estimated vulnerabilities to the communities from the hazards identified. As with any assessment involving natural or man-made hazards, all potential events may not be represented here and an actual incident may occur in a vastly different way than described. This assessment, however, will be used, where possible, to minimize damages from these events in the future.

Every type of event is different, ranging from population to property to economic impacts. Incidents also have different probabilities and magnitudes even within hazards. For example, a small earthquake will be different than a large earthquake and a moderate flood will be different from both of those. In an attempt to rate hazards and prioritize mitigation activities, a summary of the impacts from an event is presented in Table 4.69. Some hazards have estimates of dollar losses and population impacted whereas others are more qualitatively assessed based on available information from the risk assessment process. For more information on these determinations, see the individual hazard profiles.

Table 4.69 Summary of Hazards for Granite County, Montana

Hazard Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Future Development Impact	Relative Overall Risk
Wildfire *Granite County*	High	High $8.2M	Moderate	High $17.3M	High	High
Flooding *All Jurisdictions*	High	High $11.5M	Moderate	Moderate	Moderate	High
Earthquake *All Jurisdictions*	Moderate	High $5.3M	Low	Moderate $490K	Moderate	Moderate
Dam Failure *All Jurisdictions*	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Hazardous Material Release *All Jurisdictions, primarily Drummond*	Moderate	Low	High	Moderate	Low	Moderate
Winter Storms and Extended Cold *All Jurisdictions*	Moderate	Low	High	Moderate	Low	Moderate
Communicable Disease *All Jurisdictions*	Moderate	Low	High	High	Low	Moderate
Utility and Communications Failure *All Jurisdictions*	Low	Low	High	High	Low	Moderate
Drought *All Jurisdictions*	Moderate	Low	Low	High	Low	Moderate
Wind, Tornadoes, and Severe Thunderstorms *All Jurisdictions*	Moderate	Low $352K	Moderate	Moderate	Low	Moderate
Transportation Accident *All Jurisdictions*	Moderate	Low	Moderate	Low	Low	Moderate
Terrorism *All Jurisdictions*	Low	Low	High	Moderate	Low	Low

Table 4.69 Summary of Hazards for Granite County, Montana (continued)

Hazard Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Future Development Impact	Relative Overall Risk
Water Supply and Watershed Contamination *All Jurisdictions, primarily Philipsburg*	Low	Low	Moderate	Moderate	Low	Low
Volcanic Ash *All Jurisdictions*	Low	Moderate	Low	Moderate	Low	Low
Avalanche and Landslide *Granite County*	Low	Low	Low	Low	Low	Low

5. Mitigation Strategy

Hazard mitigation, as defined by the Disaster Mitigation Act of 2000, is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. The development of a mitigation strategy allows the community to create a vision for preventing future disasters, establish a common set of mitigation goals, prioritize actions, and evaluate the success of such actions.

The Granite County Mitigation Strategy is based on the results of the risk assessment and recommendations by knowledgeable community members and public meetings. The overarching mission of this mitigation strategy is to:

Reduce or prevent losses from disasters.

Rather than wait until a disaster occurs, Granite County, the Town of Philipsburg, and the Town of Drummond have developed this strategy to move in a proactive direction in disaster prevention. All losses cannot be entirely mitigated, however, some actions can be taken, as funding and opportunities arise, that may reduce the impacts of disasters and eventually save taxpayers' money. The mitigation actions were developed based on direct input from the community and prioritized through a multi-step process.

Goals, Objectives, and Proposed Actions

Goal 1: Prevent community losses from wildfires.

Objective 1.1: Minimize the risk to structures in the wildland/urban interface.
- Conduct individual WUI wildfire assessments.[41]
- Encourage homeowners to reduce fuels around structures and create a fire defensible space.
- Revise subdivision regulations with a better focus on defensible space/maintenance requirements in the wildland/urban interface.
- Reduce fuels in the Maxville Highway 1 corridor.[41]

Objective 1.2: Improve wildland firefighting capabilities.
- Develop dry hydrant water supplies in the Georgetown Lake area.
- Improve ingress/egress options in existing subdivisions.

Goal 2: Reduce future damages from flooding.

Objective 2.1: Reduce losses to private property from flooding.
- Educate the public on flood insurance.
- Increase the capacity of the downtown Philipsburg storm drain for Camp Creek to prevent Broadway Street flooding.
- Increase the capacity of the Sansome Street culvert in Philipsburg on Frost Creek.
- Increase the capacity of the culvert under Highway 10A in Drummond.

Goal 3: Reduce potential losses from earthquakes.

Objective 3.1: Prevent earthquake damages to critical facilities, infrastructure, and facilities housing vulnerable populations.
- Tie down/secure objects in schools that could fall during an earthquake.
- Conduct earthquake drills in the schools.
- Retrofit critical government facilities for earthquakes.
- Inspect key bridges for seismic stability.

Objective 3.2: Prevent residential and commercial losses from earthquakes.
- Educate home and business owners on simple earthquake retrofits.
- Survey commercial structures for earthquake stability and recommend retrofits.

Goal 4: Minimize the impacts from hazardous materials releases.

Objective 4.1: Reduce the probability of hazardous materials spilling into Drummond.
- Place highway barriers along Interstate 90 in Drummond.

Goal 5: Reduce potential losses from winter storms and extended cold.

Objective 5.1: Protect the population from utility outages during winter storms and extended cold periods.
- Install generators at critical facilities, especially the Sheriff's office/911 Center.
- Develop a sheltering plan specifically for utility outages.

Objective 5.2: Prevent power outages.
- Encourage the electric companies to improve maintenance of and around power lines and substations.

Goal 6: Reduce community risk from communicable disease.

Objective 6.1: Slow the spread of communicable disease.
- Create a public education communicable disease prevention program.

Goal 7: Prevent water supply contamination.

Objective 7.1: Protect public water supply systems.
- Bury the water line that supplies the Town of Philipsburg's water system.

Goal 8: Optimize the use of all-hazard mitigation measures.

Objective 8.1: Develop resources that can be used to further study and prepare for all hazards.
- Develop GIS data that can be used with FEMA's HAZUS loss estimation models.
- Become a National Weather Service Storm Ready Community.

Objective 8.2: Enhance all-hazard warning systems.
- Place a NOAA Weather Radio Transmitter in Philipsburg.
- Put NOAA Weather Radios in critical facilities and schools.
- Develop evacuation plans for the communities.

Action Prioritization

Each of the proposed projects has value, however, time and financial constraints do not permit all of the proposed actions be implemented immediately. By prioritizing the actions, the most critical, cost effective projects can be achieved in the short term. The prioritization of the projects serves as a guide for choosing and funding projects, however, depending on the funding sources, some actions may be best achieved outside the priorities established here.

To ensure that community goals and other factors are taken into account when prioritizing projects, a prioritization model that uses the following factors has been developed: cost (including management costs), feasibility (politically, socially, and environmentally), population benefit, property benefit, and hazard rating.

Each of the factors was ranked low, moderate, or high for each of the projects. The methods used to assign a category and the associated score can be generally defined as follows:

Cost:	3 Score	*Low*: < $10,000
(including management)	2 Score	*Moderate*: $10,000-$50,000
	1 Score	*High*: >$50,000
Feasibility:	1 Score	*Low*
(politically, socially,	2 Score	*Moderate*
environmentally)	3 Score	*High*
Population Benefit:	1 Score	*Low*: < 25% of population to benefit
	2 Score	*Moderate*: 25%-75% of population to benefit
	3 Score	*High*: > 75% of population to benefit
Property Benefit:	1 Score	*Low*: < 25% of property to benefit
	2 Score	*Moderate*: 25%-75% of property to benefit
	3 Score	*High*: > 75% of property to benefit
Hazard Rating:	1 Score	*Low*
(from risk assessment summary)	2 Score	*Moderate*
	3 Score	*High*

A summary of the scores for each of the proposed projects can be found in Table 5.1.

Table 5.1 Proposed Actions and Priority Scores for Granite County

Goal 1: Prevent community losses from wildfires.						
Project	*Cost*	*Feasibility*	*Population Benefit*	*Property Benefit*	*Hazard Rating*	*Score*
Individual WUI structure wildfire assessments	Low	Moderate	Moderate	Moderate	High	12
Homeowner defensible space	Moderate	Moderate	Moderate	Moderate	High	11
WUI subdivision regulations	Low	Moderate	Moderate	Moderate	High	12
Maxville Highway 1 fuels reduction	Moderate	Moderate	Moderate	Moderate	High	11
Georgetown Lake dry hydrants	High	Moderate	Moderate	Moderate	High	10
Ingress/Egress improvements	High	Moderate	Moderate	Moderate	High	10
Goal 2: Reduce future damages from flooding.						
Project	*Cost*	*Feasibility*	*Population Benefit*	*Property Benefit*	*Hazard Ratings*	*Score*
Flood insurance education	Low	Moderate	Moderate	Moderate	High	12
Camp Creek storm drain	High	Moderate	Moderate	Moderate	High	10
Sansome Street culvert	Moderate	Moderate	Moderate	Moderate	High	11
Highway 10A culvert	Moderate	Moderate	Moderate	Moderate	High	11
Goal 3: Reduce potential losses from earthquakes.						
Project	*Cost*	*Feasibility*	*Population Benefit*	*Property Benefit*	*Hazard Ratings*	*Score*
School seismic tie downs	Low	High	Moderate	Low	Moderate	11
School earthquake drills	Low	High	Moderate	Low	Moderate	11
Critical facilities earthquake retrofit	Moderate	High	Moderate	Moderate	Moderate	11
Bridge seismic study	Moderate	High	Moderate	Moderate	Moderate	11
Home and business seismic retrofit education	Low	Moderate	Moderate	Moderate	Moderate	11
Commercial seismic survey	Moderate	Moderate	Moderate	Moderate	Moderate	10
Goal 4: Minimize the impacts from hazardous materials releases.						
Project	*Cost*	*Feasibility*	*Population Benefit*	*Property Benefit*	*Hazard Ratings*	*Score*
I-90 highway barriers	Moderate	Moderate	Moderate	Moderate	Moderate	10
Goal 5: Reduce potential losses from winter storms and extended cold.						
Project	*Cost*	*Feasibility*	*Population Benefit*	*Property Benefit*	*Hazard Ratings*	*Score*
Critical facility generators	Moderate	High	High	Low	Moderate	11
Utility outage sheltering plan	Low	High	Moderate	Low	Moderate	11
Utility maintenance	Low	Moderate	Moderate	Low	Moderate	10

Table 5.1 Proposed Actions and Priority Scores for Granite County (continued)

Goal 6: Reduce community risk from communicable disease.						
Project	*Cost*	*Feasibility*	*Population Benefit*	*Property Benefit*	*Hazard Ratings*	*Score*
Communicable disease education	Low	Moderate	Moderate	Low	Moderate	10
Goal 7: Prevent water supply contamination.						
Project	*Cost*	*Feasibility*	*Population Benefit*	*Property Benefit*	*Hazard Ratings*	*Score*
Bury Philipsburg water line	Moderate	Moderate	Moderate	Low	Low	8
Goal 8: Optimize the use of all-hazard mitigation measures.						
Project	*Cost*	*Feasibility*	*Population Benefit*	*Property Benefit*	*Hazard Ratings*	*Score*
HAZUS GIS data development	Moderate	High	Moderate	Moderate	High	12
NWS Storm Ready	Low	Moderate	Moderate	Low	High	11
NOAA Weather Radio transmitter in Philipsburg	Moderate	Moderate	High	Low	High	11
NOAA Weather Radios in critical facilities and schools	Low	Moderate	Moderate	Low	High	11
Evacuations plans	Low	High	Moderate	Low	High	12

Implementation Plan

Those actions that have received the highest scores are given the highest priority. As funding or opportunities to initiate these projects come up, the higher priority activities can be prioritized even further with more detailed costs, benefits, and other criteria. The implementation plan may be modified to suit the needs of the community. The implementation strategy for the proposed actions can be found in Table 5.2. Table 5.3 shows the timeframes for the top five mitigation priorities. All other projects are longer term, but where feasible, will be completed in the short term.

Table 5.2 Implementation Plan for Actions in Granite County

Project Description	Jurisdiction	Responsible Department/Partner	Potential Funding Source(s)	Priority Score
Conduct individual WUI wildfire assessments.	Granite County	Fire Departments Homeowners USFS/BLM/DNRC	USFS/BLM Firewise DNRC Private	12
Revise subdivision regulations with a better focus on defensible space/maintenance requirements in the wildland/urban interface.	Granite County Philipsburg Drummond	Planning Board Fire Departments	Internal	12
Educate the public on flood insurance.	Granite County Philipsburg Drummond	DES Coordinator Floodplain Manager Insurance Agents	FEMA Internal Private	12
Develop GIS data that can be used with FEMA's HAZUS loss estimation models.	Granite County Philipsburg Drummond	Commissioners Town Councils DES Coordinator Planning Board	FEMA Internal	12
Develop evacuation plans for the communities.	Granite County Philipsburg Drummond	DES Coordinator Law Enforcement Fire Departments	Internal FEMA Red Cross	12
Encourage homeowners to reduce fuels around structures and create a fire defensible space.	Granite County	Fire Departments Homeowners USFS/BLM/DNRC	USFS/BLM Firewise DNRC Private	11
Reduce fuels in the Maxville Highway 1 corridor.	Granite County	Fire Departments USFS/BLM/DNRC	USFS/BLM DNRC Private	11
Increase the capacity of the Sansome Street culvert in Philipsburg on Frost Creek.	Philipsburg	Public Works DES Coordinator	FEMA Internal	11
Increase the capacity of the culvert under Highway 10A in Drummond.	Drummond	Public Works DES Coordinator	FEMA Internal	11
Tie down/secure objects in schools that could fall during an earthquake.	Granite County Philipsburg Drummond	School Districts DES Coordinator	FEMA Internal	11
Conduct earthquake drills in the schools.	Granite County Philipsburg Drummond	School Districts	Internal	11
Retrofit critical government facilities for earthquakes.	Granite County Philipsburg Drummond	Commissioners Town Councils DES Coordinator	FEMA Internal	11
Inspect key bridges for seismic stability.	Granite County Philipsburg Drummond	Road Departments Montana DOT	FEMA MT DOT Internal	11

Table 5.2 Implementation Plan for Actions in Granite County (continued)

Project Description	Jurisdiction	Responsible Department/Partner	Potential Funding Source(s)	Priority Score
Educate home and business owners on simple earthquake retrofits.	Granite County Philipsburg Drummond	DES Coordinator Insurance Agents Individuals	FEMA Internal Private	11
Install generators at critical facilities, especially the Sheriff's office/911 Center.	Granite County Philipsburg Drummond	Commissioners Town Councils DES Coordinator	FEMA DHS Internal	11
Develop a sheltering plan specifically for utility outages.	Granite County Philipsburg Drummond	Red Cross DES Coordinator	Internal	11
Become a National Weather Service Storm Ready Community.	Granite County Philipsburg Drummond	DES Coordinator NWS	Internal	11
Place a NOAA Weather Radio Transmitter in Philipsburg.	Granite County Philipsburg Drummond	DES Coordinator NWS	FEMA NWS Internal	11
Put NOAA Weather Radios in critical facilities and schools.	Granite County Philipsburg Drummond	DES Coordinator School Districts	FEMA NWS Internal	11
Develop dry hydrant water supplies in the Georgetown Lake area.	Granite County	Fire Department Commissioners Homeowners	FEMA Internal Private	10
Improve ingress/egress options in existing subdivisions.	Granite County	Fire Departments Commissioners Homeowners	FEMA Internal Private	10
Increase the capacity of the downtown Philipsburg storm drain for Camp Creek to prevent Broadway Street flooding.	Philipsburg	Public Works DES Coordinator	FEMA Internal	10
Survey commercial structures for earthquake stability and recommend retrofits.	Granite County Philipsburg Drummond	DES Coordinator Chamber of Commerce	FEMA Internal Private	10
Place highway barriers along Interstate 90 in Drummond.	Drummond	Montana DOT Town Council	MT DOT	10
Encourage the electric companies to improve maintenance of and around power lines and substations.	Granite County Philipsburg Drummond	Commissioners Town Councils Utility Providers	Private	10
Create a public education communicable disease prevention program.	Granite County Philipsburg Drummond	Health Board DES Coordinator	DPHHS DHS Internal	10
Bury the water line that supplies the Town of Philipsburg's water system.	Philipsburg	Public Works	FEMA DHS Internal	8

Table 5.3 Timeframes for Projects with a Priority Score of 12

Project Description	Timeframe
Conduct individual WUI wildfire assessments.	Ongoing – Goal of 50 per year
Revise subdivision regulations with a better focus on defensible space/maintenance requirements in the wildland/urban interface.	Short Term – 1 to 2 years
Educate the public on flood insurance.	Short Term – 1 to 2 years
Develop GIS data that can be used with FEMA's HAZUS loss estimation models.	Medium Term – 2 to 5 years
Develop evacuation plans for the communities.	Short Term – 1 to 2 years

Enabling Legislation

The enabling legislation for the implementation of this plan specifically comes from Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390). The Interim Final Rule for this legislation was published in the Federal Register on February 26, 2002 at 44 CFR Part 201. Other legislation, orders, and plans that support the initiatives presented in this plan include:

- Presidential Executive Order 12898, Environmental Justice
- Presidential Executive Order 11988, Floodplain Management
- Presidential Executive Order 11990, Protection of Wetlands
- Montana Code Annotated, Title 10, Chapter 3, Disaster and Emergency Services
- Montana Code Annotated, Title 76, Chapter 5, Flood Plain and Floodway Management
- Montana Code Annotated, Title 50, Chapter 60, Building Construction Standards
- Montana Code Annotated, Title 76, Chapter 2, Planning and Zoning
- Granite County Growth Policy
- Granite County, Town of Philipsburg, Town of Drummond Subdivision Regulations
- Granite County, Town of Philipsburg, Town of Drummond Floodplain Ordinances

Existing Programs

The approval of this plan shows that hazard mitigation is an important priority in Granite County, Philipsburg, and Drummond. As a priority, the hazard information and recommendations presented in this plan will be considered and incorporated into current and future planning initiatives, particularly growth policies, capital improvement plans, zoning regulations, and subdivision regulations.

Additional support for mitigation will be encouraged by the Granite County Planning Board and Fire Departments through the improvements of subdivision regulations. The many organizations devoted to sustainable communities and the protection of natural resources will be encouraged to use this plan and support its goals.

6. Plan Maintenance Procedures

Plan Monitoring, Evaluation, and Updates

This plan is maintained by the Granite County Local Emergency Planning Committee (LEPC). This committee has representatives from local public safety departments and private entities. All were active in the development of this plan. Annually at the November LEPC meeting, a public meeting will be held to review the plan. Notices will be posted in The Philipsburg Mail newspaper. Annual updates should be made and committee approval may then take place at the January meeting or subsequent meetings. As hazard information is added or updated, events occur, and projects are completed, the plan will be updated. Each year, a notice of approval will be sent to Montana Disaster & Emergency Services by the Granite County DES Coordinator, and if major changes take place, a revised version of the plan will also be submitted. Every five years, the plan will be submitted to Montana Disaster & Emergency Services and the Federal Emergency Management Agency Regional Office for their approval. The next formal submission will occur in December 2010. Table 6.1 outlines the update schedule for the plan.

Table 6.1 Granite County Schedule of Updates

Plan Section	Post-Disaster	Annually	Every 5 Years
Annual Report to Montana DES		X	X
Adoption Documentation	X	X	X
Introduction			X
Planning Process	X	X	X
Hazard Identification	X		X
Critical Facilities			X
Buildings			X
Population			X
Infrastructure			X
Economy			X
Land Use and Future Development			X
Vulnerability Assessment Methodology			X
Hazard Profiles	X	X	X
Risk Assessment Summary			X
Goals, Objectives, and Proposed Actions	X	X	X
Action Prioritization	X	X	X
Implementation Plan	X	X	X
Plan Maintenance Procedures			X

Public Involvement

An important aspect of this plan since its inception has been public involvement. To encourage continued participation, comments can be directed to the Granite County LEPC. This committee can be reached through Granite County Disaster & Emergency Services at:

Granite County Disaster & Emergency Services
c/o Mike Kahoe
PO Box 925
Philipsburg, MT 59858
406-859-3771

Comments will be considered during the annual review of this plan. The public is also encouraged to attend the annual plan review meeting. If needed, a special LEPC subcommittee will be developed to hold public meetings and coordinate plan changes and comments.

Appendix A

Public Meeting Documentation

Appendix B

Meeting Attendance Records

Appendix C

References/Footnotes

References/Footnotes

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Appendix D

Acronyms

Acronyms

BLM – Bureau of Land Management
BNSF – Burlington Northern Santa Fe
BSE – Bovine Spongiform Encephalopathy
CAMA – Computer Assisted Mass Appraisal
CFR – Code of Federal Regulations
CWPP – Community Wildfire Protection Plan
DES – Disaster and Emergency Services
DHS – Department of Homeland Security
DNRC – Department of Natural Resources and Conservation
DOT – Department of Transportation
DPHHS – Department of Public Health and Human Services
EOC – Emergency Operations Center
EPA – Environmental Protection Agency
FAA – Federal Aviation Administration
FBI – Federal Bureau of Investigation
FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map
FIS – Flood Insurance Study
GIS – Geographic Information System
HAZUS-MH – Hazards US Multi-Hazard
LEPC – Local Emergency Planning Committee
MBMG – Montana Bureau of Mines and Geology
MRL – Montana Rail Link
NF – National Forest
NFIP – National Flood Insurance Program
NID – National Inventory of Dams
NOAA – National Oceanic and Atmospheric Administration
NTSB – National Transportation & Safety Board
NWS – National Weather Service
PGA – Peak Ground Acceleration
PRCA – Professional Rodeo Cowboys Association
QRU – Quick Response Unit
SFHA – Special Flood Hazard Area
USDA – United States Department of Agriculture
USGS – United States Geological Survey
USFS – United States Forest Service
WUI – Wildland/Urban Interface
YVO – Yellowstone Volcano Observatory

Appendix E

Crosswalk Reference Document

Appendix F

FEMA/State Approval Letter